The Ship-builders Assistant:

OR, SOME

ESSAYS

Towards Compleating the ART of

Marine Architecture:

VIZ.

I. A GENERAL INTRODUCTION, wherein is consider'd the SOLID OF LEAST RESISTANCE, so far as relates to the Formation of a Ship's Body, *&c.*
II. Observations for Regulating the PRICE of TIMBER, taken from the Proportion of its different Dimensions; with Estimates of the Value of Oak Timber, and several other Materials relating to NAVAL STORES.
III. Rules for Building the HULL of any Sort of SHIPS. To which is added the *Scantling* or *Measuring* of SHIP-TIMBERS, and some Directions about MOULDING them.
IV. A New Method for finding the TUNNAGE of any SHIP.
V. Rules for Proportioning the RIGGING.

To which is Annexed,
An Explication of the PRINCIPAL TERMS used in this ART.
The whole Illustrated with many SCHEMES *proper to each Part, most of them from* COPPER PLATES.

By WILLIAM SUTHERLAND, *Shipwright and Mariner.*

LONDON:
Printed for R. MOUNT on *Tower-hill*, A. BELL at the Cross-keys and Bible, and R. SMITH under the *Royal Exchange, Cornhill.* 1711.

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Towards C[illegible] the Art of

Marine Architecture:

I. A General [illegible] ([illegible]) [illegible] to [illegible] the [illegible].

II. Observations for Raising a Parcel of Timber taken from the Proportion of its different Dimensions; with Estimates of the Value of Oak-Timber, and several other Materials relating to Naval Stores.

III. Rules for Building the Hull of any Sort of Ships. To which is added the [illegible] and some Dimensions about Masts [illegible] them.

IV. A New Method for finding the Tunnage of any Ship.

V. Rules for Proportioning the Rigging.

To which is annexed,

An Explication of the Principal Terms used in the Art.

The whole Illustrated with many Schemes, proper to each Part, engrav'd on Copper Plates.

By William Sutherland, Ship-wright and Mathematician.

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Printed for R. Mount on Tower-hill, A. Bell at the Cross-[illegible] and R. Smith [illegible] Royal Exchange, Cornhill. 1711.

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To the RIGHT HONOURABLE the

LORDS COMMISSIONERS

For Executing the Office of

Lord HIGH ADMIRAL

Of *Great Britain* and *Ireland*, &c.

May it please Your Lordships,

THIS small Treatise of *Marine Architecture* approaches Your Lordships, with the greatest Sense both of Duty and Respect. And as both the Subject it self, and the Circumstances of its Author, make it Your Lord-

ships by a kind of Right, I am incouraged to hope it will meet with a favourable Reception. There is besides another Reason, not to say Necessity, which obliges it to address it self to Your Lordships Patronage. Novelty is always liable to a heavy Charge, and to go out of the common Road, to recede from old and establish'd Customs, in advancing any thing new either in Notion or Practice, lays a Man open to the Censure of the general Part of Mankind, who govern themselves rather from Example, than from a due Consideration of the Nature of things, and Pursuit of Truth. But whatever Entertainment this Treatise (in which there are many things wholly new) may on that account meet with from some others, I perswade my self that will be so far from rendering it less acceptable to Your Lordships, as 'twill rather intitle it to a favourable Protection. For whatsoever may have a Tendency to the Improvement of any Branch of that excellent and useful Art of Navigation, which contributes so greatly to the Safety and Honour of the Nation, the Advancement of

Trade, and general Prosperity, can't but meet with Your Lordship's Approbation, on whom the Successes of our Royal Navy, under God, and our most Gracious Queen, so very much depend.

How well I have succeeded in the Attempt, is humbly submitted to Your Lordships Judgments, which if they prove so far in favour of this Performance, as that Your Lordships shall esteem it in any measure conducive to a further Advancement of the Art of Ship-building, I shall think my Labour abundantly rewarded, and my self extremely happy in this Fruit of many Years Study and Experience. And 'twill likewise be an Incouragement to hope it may find a candid Reception with all ingenuous Persons and Lovers of Art, who have their Country's Interest truly at heart; Improvements of this kind being so very serviceable to our Successes by Sea. Which as they have been hitherto very great, since the Accession of our most Gracious Queen to the Throne; so that

they may not only still continue, but constantly increase, under Your Lordships Wise and Prudent Administration, is the sincere and hearty Desire of,

May it please Your Lordships,

Your Lordships most Humble,

and most Obedient Servant,

W. Sutherland.

PREFACE.

THE great Usefulness of the Art of Ship-building is so well known to All, that to say any thing of it here would be wholly unnecessary; and those who have any Acquaintance with it must be sensible, that neither the Theory nor Practice has hitherto been so far advanced, but that both are yet capable of very great Improvements. Not to insist therefore either upon the Advantages of this excellent Art, or the Defects it still continues to labour under, I shall content my self to acquaint the Reader, as briefly as I can, with some of the principal things which have been attempted in this Treatise, to render it more compleat and perfect.

I have first endeavour'd to shew, how all Shipping in general may be regularly shaped, without puzzling young Beginners, and by what Method any Timber may be nicely adapted to its various Uses; which will be a Means to incline Youth to delight in their Studies, and likewise be very advantageous to all such as are concerned either in buying or selling Timber.

I have also shewed the exact Strike, which ought to be punctually minded in measuring of Timber, which, if it be rightly considered according to the Method described, will appear to make the Timber directly what it was in the rough and round Position. But if Timber be measured in a round Tree for square Timber, it gives every Piece ¼ more than it really contains.

You have likewise Rules whereby to adjust the several Prices, not only of all Timber, but also of Ships, taken from the Cube Root of the Tunnage; also distinct Tables calculated of the Price and Value both of rough and converted Timber, as also Knees, Plank, and Trenels.

Some Directions are given for Launching or Lowering Ships into the Water; as also for making Provision to erect them on a sure Foundation, in order to prevent their miscarrying one way or another.

I have also ſhewed how all Plank and Timber may be provided for Ship-work with Frugality, and how this Branch of our own Manufactures may be encouraged both to the Advantage of the Proprietor, and in building Ships much cheaper than has hitherto been practiſed.

Some brief Remarks are laid down relating to what is principally to be obſerved in ſhaping of Ships, and the Difference between their Power and Reſiſtance, for reducing them to a more exact Trim.

I have fully ſhewn how to make any Ship convenient for its various Uſes, to prevent needleſs Diſputes or chargeable Alterations afterwards, which have formerly been too frequent; alſo how every Part of a Ship may be properly placed with Advantage to the Strength of the Ship; with a very plain and intelligible Method for Planking Ships without-board, from the Keel to the Top of the Side; how all Plank may be brought to exact Lengths and Breadths, and ſo exactly ſhaped, that ¼ both within-board and without may be ſaved in converting it; which Advantage 'tis hoped may be an Encouragement to the Proprietors of our English *ſound and ſerviceable Timber.*

A general Rule is given for the Sheering or crookeding the Wales of all ſorts of Ships and ſmall Veſſels, from a Ship of 170 Feet long to a Boat of 10 Feet long.

A plain and eaſy Method is laid down for delineating any ſort of Veſſel, great or ſmall, as alſo how to beautify her, with Rules for ſhaping the Head, Stern, or Galleries, and for erecting Stairs to go from one Deck to another. All which will be very neceſſary to be known and agreed upon, to ſave the trouble of Alterations, and garniſhing Ships divers times, which is very chargeable.

I have propoſed a Method for ſcantling or meaſuring the Parts of a Ship of 500 Tuns, from whence I have given a Rule whereby the Parts of any other Ships may be found, which will prove very convenient in contracting and building new Ships; to which I have ſubjoined the accuſtomary way of Meaſuring.

I have likewiſe ſhewed how a Bend of Moulds may be croſſed,

and a Ship's Body laid down in a Mould Loft, with some particular Uses of such a Place, and what ought principally to be considered in moulding a Ship's Frame.

You have a most exact and accurate Method whereby to measure the Tunnage of any Ship, insomuch that any Person may be fully satisfied what the proper Tunnage of his Ship is, and what the Divisor ought to be in casting any Ship's Burden, let her be ever so full bodied, or otherwise very thin and sharp.

Lastly, I have laid down some general Rules how to Rig any Ship, and to size the Rigging and every Utensil proper for the Work; and having described the Custom of Rigging a Ship of 600 Tuns, from thence and some other Sizes, I have drawn a general Proportion for Rigging any Three-mast Ship.

The Principles on which I have proceeded will, I hope, be found both certain and evident, and the Observations drawn from them, in order for Practice, no less clear and feasible. For I have endeavour'd thro' the whole Treatise to join Theory and Practice hand in hand, being sensible that the former without the latter affords little more than a Shadow instead of Substance. I have likewise every where studied Plainness, as much as the Nature of the Subject would allow, so as to render all I advance intelligible to every Capacity. And for the better Illustration of the Work, I have prepared Figures to shew the Nature of each part of it, since in Subjects of this kind no Description by Words can convey so clear an Idea to the Mind of the things treated of, as a true and exact Draught of them, which most of these will be found to be, being taken from a Scale, so that the Rigging may be exactly cut without any Wast.

'Tis the Product of 32 Years Study and Experience; for 'tis very well known that I have been so long imploy'd in her Majesty's Service, and that of her Royal Predecessors; so that I may say, I was in a manner born a Seaman, as most of my Ancestors were. My Grandfather was Foreman to the Shipwrights in her Majesty's Yard at Deptford *30 Years, my Uncle Mr.* Bagwell *died Master Builder of her Majesty's Yard at* Portsmouth, *my Father and several of my Relations were Master Carpenters in the Royal*

a *Navy,*

Navy, and I my *self have had the Honour to act in the Quality of Master Carpenter of three of her Majesty's Ships, and for* 15 *Years last past have served her Majesty, in the Inspection and Direction of the Work done by part of the Shipwrights at* Portsmouth *and* Deptford *Yards. During which time I have made it my Study to forward Youth, and make them expert in the Art of Ship-building.*

After this Account both of the Book and its Author, it may not be amiss just to mention some of the principal Uses proposed by it.

And first, it will shew the Country Gentlemen how to make the greatest Advantage of their Timber, and by that means incourage them to plant other Trees in the room of those they cut down.

It will likewise inform Ship-builders how to make the best Use of Plank and Timber, with Regard to the Expence; so that all Shipping may be built much cheaper and stronger than formerly.

It will also be of service to Owners of Ships, in directing them how to measure their Ships, and to know exactly what they will safely bear, and carry from one place to another, without hazarding the Goods so transported.

It will be a Guide for Youth to forward them in their Practice, both as to the Building and Rigging of Ships; so that any Man may be a Sailer before he goes on board a Ship. And it may also be very advantageous to Merchants, Owners, and any others concern'd in Shipping, by shewing them the exact Quality and Quantity of Masts and Rigging, which will be requisite both for present Use, and for the Wear of each respective Utensil.

Nor can it be unpleasant for any to peruse and see how the Business of Shipping, our greatest Defence, is managed, and what a Variety both of Matter and Art is required in forming such surprizing Machines, and rendring them fit for Use.

I shall add no more, but heartily to desire it may answer the End I design'd by it, which is a general Good to these Kingdoms. If it prove so, it will be a Motive to a further Application of my Thoughts on this Subject, which if duly prosecuted, I doubt not but in time it may be made appear, that Ship-building may be reduced to as certain Principles, and explained by as clear and demonstrable Rules, as any other Art whatever.

CON-

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I ESSAY.

II ESSAY, for regulating the Price of several Naval Stores.

III ESSAY, upon Marine Architecture.

IV ESSAY, for finding the exact Tunnage of any Ship.

Weight

CONTENTS.

ERRATA.

PAg. 7. l. 29. for *Str.* read *Feet.* P. 22. l. 37. r. *its.* P. 25. l. 37. r. *Tenon.* P. 30. l. 33. r. *Qualities.* P. 35. l. 14. r. *Tenon.* Ib. l. 31. r. *bevelling.* P. 37. l. 18. r. *Eyes.* P. 47. l. 3. r. *Stem.* P. 64. l. 2. r. *Tack-piece.* Ib. l. 3. r. *Carved.* P. 78. l. 26. r. *bevel'd.* P. 94. l. 3. for 4 C. r. 89 *Pound* ½. P. 109. l. 12. r. *its.* P. 119. l. 20. r. *Tack.* P. 149. l. 8. r. *one.*

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SOME

ESSAYS

Towards Compleating the ART of

Ship-building.

JAcobus *Acontius*, a most Excellent Man, being disturb'd at the Humour of Scribling which prevail'd in his time, wish'd none might be suffer'd to Write or Publish any thing, unless it was some New Matter, both of the Author's own Observation, and which might make for the Glory of the Age. Such a Provision would for the future be an effectual Bar to all those who aim at a Reputation from the Writings, Demonstrations, and Works of others.

Great Improvements have been made in Mathematicks and most Parts of Philosophy, by the publishing of which the Learned in those Faculties have very much oblig'd the World, so that those main Parts of useful Learning are now brought to a very great height.

Plato examin'd the Cutting of a Sphere or Globe, and reduc'd the Dividing it into Five Regular Bodies, from which several Mathematicians have observ'd there can be no more than Five Regular Bodies produced from the same Solid. And he further tells us, that Regular Curves are such as the Perimeters of the Conic Section; but irregular Curves such as have Points of Inflection, or the Curve reverted: And that besides such regular Bodies that agree to Rule, there are no others that will correspond to the Definition.

The Antients at ſeveral times, and upon different Occaſions, eſtabliſh'd Five Orders in Architecture, to which they give different Names. But as to a SHIP, which is the Subject of our preſent Diſcourſe, the regular forming or naming of her Parts was ſcarce ever yet done.

The firſt Shipwright that was ever publickly obſerved to inquire into the regular forming a Ship, was Sir *Phin. Pett*, one of our former Maſter-Builders, who being aſſiſted by that famous Mathematician Dr. *Wallis*, compoſed a Solid, which he called a *Cono-cuneus*, being one ½ Cone, and one ½ Wedge, called by ſome the *Shipwright's Circular Wedge*, which was allowed to be a good Foundation for the Art of Ship-building, (for it produced Variety of Curves) and extremely requiſite to reconcile ſo confuſed a Form as a Ship was then, and is ſtill thought to have.

Since that Time Shipwrights have been conſtantly attempting to perfect the Rudiments of building and equipping this Noble Machine; tho' a regular Ship, conſiſting of every good Property requiſite to its Uſes, cannot be yet warranted.

The incomparable Sir *Iſaac Newton* has indeed demonſtrated a Solid, which he calls the Solid of Leaſt Reſiſtance, and hints that it may be very uſeful in building Ships. 'Tis generated by the Rotation of a crooked Line about its Axis, and is blunt and flat-headed. But being form'd by one Rotation, the Water equally effects it, and every Particle of Water paſſes direct, without being confuſed, or divided into irregular Shapes.

Arts may be very much help'd by obſerving how Nature diſplays her ſelf in forming of Creatures ſuitably to their various Actions in their ſeveral Elements.

Mackerel and Dolphins are curiouſly formed, perfectly Convex, without Inflexion; their Fins very thin, but firm, and being placed perpendicular from the Line of Direction, or Center of the Body, keep them ſteddy in their moving, making the Motion uniform and perpetual, according to their natural Tendency. It may be farther obſerved how curiouſly their Fins are furl'd up, and again ſprouted out at pleaſure, to traverſe their Bodies, and turn them to their Chace, and uſeful Poſition. And thoſe are the external Qualities, which produce their admirable Activity and Nimbleneſs, in their natural Fluid.

To ſee a Duck ſwim is not unpleaſant, how nicely ſhe makes her Stroke, and ſwiftly moves a large Body, with only two Feet,

like

like Paddles, in comparison to the Body so drove.

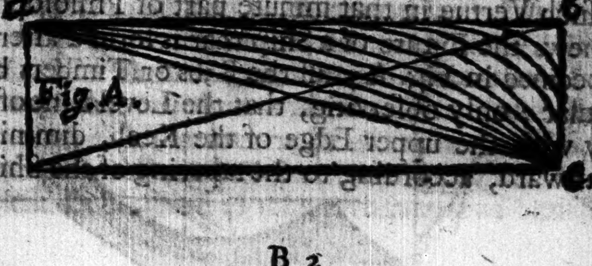
And indeed the Bodies of such Creatures being Mathematically form'd according to their Lengths, Breadths, and Depths, 'tis altogether impossible to mend their Shape, but they may be of service to us in laying down such Mathematical Rules, as are used in forming them.

In Mr. *Hayes*'s Fluxions is investigated the Center of Gravity of divers solid Bodies. And altho' Variety of Considerations will be requisite in pitching on the Centers of Gravity in a Ship, or such a moving Machine; yet such Considerations ought to be, before the direct Center of the Mast's Place can be exactly known.

Specific Gravity being fully explain'd in Dr. *Harris*'s Dictionary, there will be no Difficulty to know how any Bodies (let them be ever so different in their Weight or Bulk) will immerse in various Fluids.

The Laws of Hydrostatics inform us, that the Weight of a floating Body is equal to the room its immers'd Part takes up in the Water; so that the whole Ship, Equipping, and what weighs or leans upon her, presses neither more nor less upon the Bottom she swims over, than as much Water as is equal in Bulk to that part of the Ship which is beneath the Surface of the Water.

From which Principles may be drawn some exact Rules nicely to Equip, Load and Trim every particular Ship, both for Motion and Conveniency, and by Consequence positively to know what Advantage or Disadvantage will accrue to Shipping in general. But this will only be found in regular Bodies, that are genuinely form'd by some known Line between a Cone and a Cylinder, as may be seen in Figure *A.* where every intermediate Line in the Right Angle *a b c*, will be applicable towards regularly forming any Ship's Body.



And

And the Benefit that will follow to Shipping from such Observations will be infinite.

First, The Art will be made perfect, that there will be no Occasion for chargeable or fruitless Projects.

Secondly, Ships will not by bad Faculties miscarry, since it may be absolutely known whether they are for Service or not.

And *Thirdly*, The Materials may be provided as exactly as so many Thousand Bricks, or Loads of Timber, to build a House, or any Fabric: Of each of which I shall make a brief Explanation, as follows.

First, The Art will be made perfect, that is, the absolute Shape requisite in building any Ship, will be exactly known; altho' there may be a great many Lines drawn between a Cone and a Cylinder, as may be seen in the Figure, what Transverse Lines may be drawn between Half the Length and Half the Breadth of any Ship. For since the Body of any Ship regularly form'd is no other than a hanging Conoide, those Lines will be reciprocal to such a Figure. Notwithstanding I doubt not but it will be objected, that there may be a great number of Lines drawn in such a Figure, compar'd to a Ship's Body; but yet the Number will bear no Proportion to the Number of Shipping that has been built.

Perfect Circular Bodies have been universally condemn'd, and yet at length found to be the most suitable in every Respect. For altho' the middle Part of a Ship should be shaped by perfect Circles, the Extremes turn themselves into quite different Shapes, and also Action and Reaction in a Fluid is equal.

Besides such Projecting Angles, as have been allowed to assist a Ship in making her easy and steddy in the Sea, are so very small in Proportion to the Knee of the Head, Keel and Rudder, that it would be impossible for such Parts to be held to the Ship's Body, was there such Vertue in that minute part of Philosophy.

Fig. B. shews the Figure of a Ship that is form'd after the manner as is specified in Fig. A; all the Ribs or Timbers being perfectly Circular; only observing, that the Level Line of the Floor lies directly with the upper Edge of the Keel, diminishing forward and aftward, according to the tapering of the Ships Body.

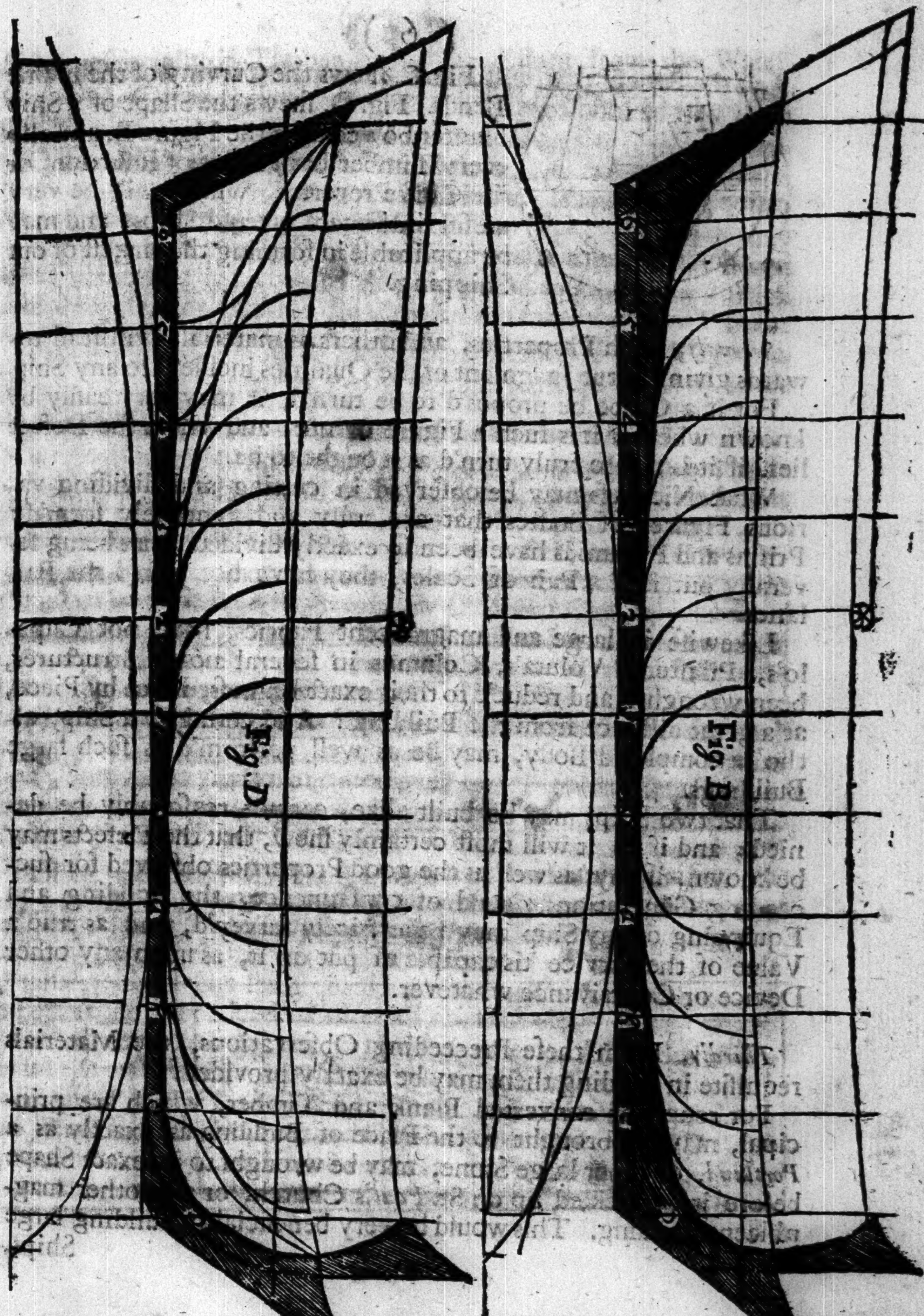


Fig. D
Fig. B

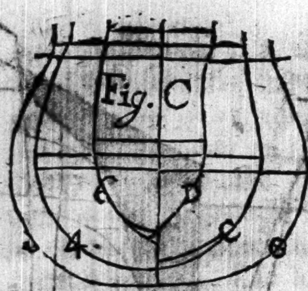


Fig. C. shews the Curving of the Frame Bends. Fig. D. shews the Shape of a Ship blunter bowed than the Figure B. and also every Timber has a Point of Inflexion, or the Curve reverted, which will be very useful in Square Stern'd Ships, and may be applicable in forming the largest of our Shipping.

Secondly, Such Properties, and others as material, will lead towards giving a true Judgment of the Qualities incident to any Ship.

For if a Globe be propos'd to be turn'd, it may very easily be known whether it is such a Figure or not, and where the Defect lies, if it is not so truly turn'd as it ought to be.

What Niceness may be observed in cutting and dividing various Figures of Bodies that are truly and genuinely form'd? Prisms and Pyramids have been so exactly divided, that being severally put into a Pair of Scales, they have not turn'd the Ballance.

Likewise in large and magnificent Fabrics, have not Cupolo's, Pilasters, Voluta's, Columns in several noble Structures, been wrought, and reduc'd to their exact Bigness, Piece by Piece, at a great distance from the Building? And certainly a Ship, altho' a complex'd Body, may be as well perform'd as such large Buildings.

That two Ships may be built alike, cannot reasonably be denied; and if so, it will most certainly shew, that the Defects may be known, if any, as well as the good Properties observed for succeeding Generations. And of consequence, the Building and Equipping of any Ship may be as nicely survey'd, and as true a Value of the Service 'tis capable of put on it, as upon any other Device or Contrivance whatever.

Thirdly, From these Preceeding Observations, the Materials requisite in building them may be exactly provided.

For rough or converted Plank and Timber, which are principal, may be brought to the Place of Building as exactly as a *Portland*, or other large Stone, may be wrought to its exact Shape before it be tackled up on St. *Paul*'s Church, or any other magnificent Building. This would be very beneficial in building large Ships,

Ships, especially if Timber grows far distant from the Water, that the Carriage is indeed near six times as much as is really requisite.

The Price of converted Timber, to that which is truly rough squar'd, is near as 3 to 1; but considering the common Defects in Timber, there is not above $\frac{1}{3}$ of rough Timber comes to Use.

And in Plank there need not be any Waste at all, but it may be exactly converted and adapted to its various Uses, altho' it was 100 Mile distant from the Ship, if it can be allowed that a Brick can be cast by any assign'd Dimension.

Otherwise there must be rough Plank as well as rough Timber, altho' the Price is near as 3 to 1, which must be allowed to be an unreasonable Waste.

I proceed now to shew some principal Considerations in Planking Ships Bottoms from the Keel to the lower Wale, of which I shall calculate some Tables.

Rates.	*Girt of the Body from the Keel to the Wale.* Feet. In.	*Girt when one Inch in a Foot is allowed.* Feet. In.
First	33—6	36—3 $\frac{1}{2}$
Second	29—3	31—8 $\frac{1}{4}$
Third	26—7	28—9—
Fourth	23—4	25—3 $\frac{1}{4}$
Fifth	18—4	19 10 $\frac{1}{4}$
Sixth	16—2	17—6—

I shall not here insert the Thickness of the Plank requisite, but refer it to the Scantling in general; and only shew the Number of Strakes, and the sizeable Breadth of them.

Rates.	*N° of Str.*	*Br.* Inch.	*N° of Str.*	*Br.* Inch.	*N° of Str.*	*Br.* Inch.	*Whole Breadth* Str. In.
First	—12—	18	—06—	14	—09—	15 $\frac{1}{2}$	36— 7 $\frac{1}{2}$
Second	—12—	16	—06—	12 $\frac{1}{4}$	—09—	13 $\frac{3}{4}$	32— 5 $\frac{1}{2}$
Third	—12—	14	—06—	11	—09—	12 $\frac{1}{2}$	28—10 $\frac{1}{2}$
Fourth	—12—	12 $\frac{1}{2}$	—06—	9 $\frac{3}{4}$	—09—	10 $\frac{3}{4}$	25— 4 $\frac{3}{4}$
Fifth	—12—	9 $\frac{3}{4}$	—06—	7 $\frac{3}{4}$	—09—	8 $\frac{1}{2}$	20— 0
Sixth	—12—	8 $\frac{3}{4}$	—06—	6 $\frac{3}{4}$	—09—	7 $\frac{1}{2}$	17— 9

But I ſhould rather leſſen the Number, and add to the Breadth in ſome Ships, from the Second Rate downward.

Rates.	*N° of Str.*	*Br.*	*N° of Str.*	*Br.*	*N° of Str.*	*Br.*	*WholeBreadth.*
		Inch.		*Inch.*		*Inch.*	
Second	—11—	17	—5—	14.	—8—	15	31—3
Third	—10—	17	—5—	12	—8—	14	28—6
Fourth	—10—	15	—5—	12	—7—	13	25—0
Fifth	—13—	14 $\frac{1}{2}$	—4—	12	——	——	19—8 $\frac{1}{2}$
Sixth	— 8—	14	—4—	11	—4—	13 $\frac{1}{2}$	17—6

By this Table it appears, that no Strake is above 18 Inches broad, nor none under 11; which will be very ſizeable for all Shipping from the biggeſt to the leaſt: Altho' it would be very proper that all Strakes were of equal Breadth that are of equal Thickneſs, throughout the whole Ship.

In the next place I ſhall ſhew the proper Length of the Scarph, or Over-launching the Buts, which will be requiſite in ſuch Shipping, and that will appear from a Proportion drawn from the Length of each Ship's longeſt Deck.

Rates.	*Length Gun-deck.*	*Cube Root of the Length.*	*Scarph or Over-Launching.*
	Feet.		*Feet & Parts.*
First	—170—	—5—$\frac{45}{90}$—	—6—
Second	—165—	—5—$\frac{40}{90}$—	—5—$\frac{9}{15}$—
Third	—150—	—5—$\frac{35}{90}$—	—5—$\frac{3}{4}$—
Fourth	—130—	—5—$\frac{5}{90}$—	—5—$\frac{21}{29}$—
Fifth	— 98—	—4—$\frac{6}{10}$—	—4—$\frac{19}{30}$—
Sixth	— 85—	—4—$\frac{4}{10}$—	—4—$\frac{8}{10}$—

And this may be made a general Proportion for all ſorts of Shipping, from the Scantling of the Plank that's wrought on ſuch Ships as are here mention'd.

In the next place, I ſhall deſcribe the General Strike in meaſuring Timber, which in ſome Places is nicely kept to; which is to ſee that the 4 Wanes are but equal to two Squares, as in the Figure A. The Squares are 2.2.2.2. and Wanes 1.1.1.1. So that 4 1's are equal to 2 2's. And this is really the Truth for

mea-

measuring Timber, and will bear no Argument against it. 'Tis not barely saying that an ill Custom may be solv'd in measuring the Timber; but the Price ought to be abated, for the Disadvantage the Buyer has in not discovering the Defects which might appear, was the Timber truly squar'd; for if there should be any Faults in some Pieces of Timber, by squaring, they may be as well fitted for Use round, and the Price allowed accordingly.

I shall next examine the different Strength of Timber according to the Bulk it bears, and the Detriment which may happen for want of true Judgment in cutting and converting principal Pieces, and add several Tables of the Price of Timber, as compass compared with straight, converted Beams, and other thick Stuff, Knees, Plank, and Trenels, &c.

Fig. a

AN ESSAY

Towards Regulating the Price of

Several Valuable Materials

Relating to

Naval Stores.

'TIS evident from Experience, that Square Rods of like qualified Timber, equal in Bigneſs, but unequal in Length, being ſupported at each End, and Weights hung in the middle, will bear in inverſe proportion to their Length: That is, ſuch a Rod of any Length will bear half the Weight of one half that Length; and two Rods equal and alike, evenly join'd one upon the other, will not only bear twice, but four times the Weight that one will. In like manner, any Number of ſuch Rods being laid one upon another, will bear Weights in proportion to the Square of thoſe Numbers. But if two or more ſuch Rods be laid ſide by ſide, the Weights they will then bear will be in an Arithmetical Proportion to their Number. From hence a Rule may be laid down to examine the Proportion of Strength in different Pieces of Timber.

It's

It's farther observ'd to be highly necessary to preserve Timber as whole as possible, and that it ought not to be converted, till the Uses it's design'd for be actually known: Which Caution is generally observ'd by skilful Workmen, it being a great Disadvantage to reduce Timber to smaller Scantlings than it will bear. For if a Piece of long Timber be unadvisedly cut in the middle, (not to mention the Weakness of a Ship composed of short and narrow Pieces of Plank and Timber) the Opportunity is lost of converting it to the most proper Service, as to what it would make Length-ways, which is not only as 2 to 1, but as 4 to 1; each Half before the cutting being alike serviceable one to the other, and having not only the single, but joint Properties of each other. However the Pieces will not be as 4 to 1 less in Value than they were, because they still contain their Bigness, being also applicable to Breadth and Thickness. Therefore if you imagine a Piece of Timber whose Sides are square, and of a certain Length, and another in all respects like the former, but only twice its Length; the larger Piece will contain 8 times the Quantity of the smaller, and consequently will be 8 times the Value, and every way throughout of double Scantling; by which means being adapted to various Uses, and preventing the Charge of unnecessary Piecing and Scarphing, it will be as 4 to 1, and so increase the Value as 32 to 4, that is, 8 times. But if it be consider'd what was said before concerning its Strength, it will appear that this large Piece will be but 4 times stronger than t'other. Tho' being 8 times the Quantity, it may also be naturally expected to be 8 times the Strength; but being only 4 times as strong, consequently 'tis but half the Value expected. So that the real Value of these two Pieces of Timber is but as 1 to 16.

This agrees with an Observation of Sir *William Petty* and others, that a Piece of 8 times the Quantity should be 16 times the Value; and if a Mast of 10 Inches Square and 60 Foot long be worth 30 s. one of 20 Inches Square and 80 Foot long, shall be worth 15 Pound, and one of 40 Inches square and 100 Foot long, worth 100 Pound. But they give no Reason for this, and only take it from a Custom; nor do the two last Observations agree exactly to Rule.

I shall therefore from these Principles lay down a Rule, which probably may adjust, and give at least a Proportion of the Value of large Timber compared with small. Tho' the Scarcity of the

Commodity, and extreme want of it, with several other intervening Circumstances may alter the Case very much; however these Considerations don't alter the intrinsic Value of the Materials, compared with each other, provided there be a general Use of all sorts of sound Timber proportionably to the Bulk it bears. And where the Case is not so, double Care ought to be taken to provide only such as is useful.

Wherefore finding by Experience the usual Prices of Timber at some Places to be near the Rules hereafter mention'd, I shall make one useful to the other, in order to reduce both to a general Scale, which being fully known, Persons will not hereafter be so liable to be impos'd on by those who, perhaps to rid themselves of a bad Bargain, will endeavour to over-reach others; but on the contrary, as these Commodities rise and fall, the intrinsic Value or Proportion may be still kept, and the Prices raised or abated so much *per Cent*.

If what has been already, or hereafter may be said, comes not up to a Demonstration, yet the thing occurring with so many repeated Observations, will be near enough for Practice, and the most curious Demonstration can make but an insensible Difference therein. However I shall only offer it as an Estimate, and proceed; the Design being rather to give a Proportion of the Value, than an Account of the current Price, which always will be various.

Taking it then for granted that like oblong Pieces of Timber (being as 1 to 8 in Quantity, or double to each other in Length, Breadth and Thickness) are in Value as 1 to 16; it will be found by comparing the Properties of divers such Pieces together (a Matter unsuitable in this Place to the Brevity of the Design) that the Value of like similar Pieces are in proportion to the Sursolidity of the Cubic Root of their Quantities, or as the Quantity multiply'd into their Cubic Roots; and that an equal Quantity (either *per* Foot or *per* Load) of such similar Forms, are valuable in direct Proportion to the Extent of their Homologous Dimension, or in proportion to the Cubic Roots of their Quantity.

Again, if you imagine a Parallelopipedon Piece of Timber, and another double to it either in Length or Breadth, by either of the ways the new Piece will be augmented in Value as well as Quantity: Let either of the latter Pieces be called a double Piece, and either of them be again doubled, the long Piece in Breadth, or

the ſhort one in Thickneſs, they will alſo be alike augmented in Quantity and Value: Let either of them be called a Quadruple Piece, and ſuppoſe it again doubled, the ſhort one in Length, or the long one in Thickneſs, making either way an Octuple Piece, an Oblong ſimilar to the firſt or ſingle Piece, as was before mention'd, and of 16 times the Value: Let thoſe 4 Pieces, *viz.* the Single, Double, Quadruple, Octuple, be diſtinguiſh'd according to their reſpective Orders by A. B. C. and D. then the Value and Quantity thereof is as A : B : : B : C. and B : C : : C : D. Alſo A : B : : C : D. or as 1 : B : : C : 16, conſequently B = Cubic Root of 16.

Thus — $\begin{cases} 1 : 2 : : 4 : 8 : \textit{per} \text{ Quantity.} \\ A : B : : C : D. \\ 1 : 2.52 : : 6 : 32 : : 16. \textit{ per} \text{ Value.} \end{cases}$

But 16 is a Surſolid, compounded of 2. the — Cubic Root of 8. as 6-32 is a Surſolid compounded of 1.58. and 2 : 52 of 1 : 26 the like Root of 2 : which Roots are alſo proportionable.

$\begin{cases} 1 : 1 : 26 : : 1 : 58 : 2. \\ A : B : : C : D. \end{cases}$

And by tracing this Matter throughout, it will be found, that not only ſimilar Pieces, but alſo all other regular oblong Forms of like qualified Timber, are in Value proportionable to the Surſolidity of the Cubic Roots of their Quantities; or that a Load of one ſhall be proportionable to the other, as the Cubic Roots of the Quantities; provided, as aforeſaid, all Timber of what Shape ſoever, be alike uſeful according to the Bulk it bears, and alike eaſy to come by. And this Rule I doubt not will hold without Exception in rough Timber, making a difference only in compaſs Timber, Knees, *&c.* which for their Scarcity and Uſefulneſs are of much more value than ſtraight.

But in converted Timber ſome ſmall Difference will happen, eſpecially when the Contents differ much, through the Charge of many Converſions, the Waſte which carries more or leſs in cutting, either of Square Timber or Plank, and the Value of the Piece out of which the ſame is cut, *&c.* As in Oak Board, where the Timber is required to be quarter'd; and in Trenels, where great

part

part of the Piece is wasted for the sake of the But, &c. All which ought to be duly considered before any Estimate can be set thereon. To which may be added the Hazard the Vender runs, and the Advantage the Buyer hath in seeing the Inside and discovering the Defects, which before lay hid from the most curious Search.

Upon the whole then, I shall offer this as a general Rule, that like similar and useful Pieces of Timber are valuable in proportion to the Sursolidity made of the Cubic Roots of their Quantities; or an equal Quantity of each is reciprocally proportionable to the Content of their Homologous Dimensions, or, which is all one, to the Cubic Roots of the Quantity.

Compare straight Oak with straight, Compass with Compass, Knees with Knees, Elm with Elm, Converted Timber, as Beams, Foot-hooks, Thick-stuffs, Plank, &c. to like Pieces and Forms. And hence are reduced the following Tables.

Elm in some Places is according to its meeting near as valuable as straight Oak, or within 5 *per Cent.* but Beach for its Uselesness and Plenty is not so valuable by above 12 *per Cent.*

It is farther observable, that the Method of buying a Quantity of Timber, is to add the Contents together of the several Pieces; the Quotient thereof is call'd the Meeting of that Timber, and accordingly thereto the Value of the whole Quantity is sold. Which Method, tho perhaps near enough for Practice, is not really true. For whosoever adds the respective Value of each Piece by it self, will find the Sum total considerably to exceed what it would by adjusting the Price by the aforesaid Meetings.

Neither do I perceive any General Rule to be given in so various a Matter, when every different Content alters the Case, except to add the Value of every individual Piece; which being so intricate and troublesome, I shall only take notice that this Difference arises from the Disproportion between the Contents of the large and small Timber, and the wider that is, the greater will be the Alteration, the Value of the large being much diminish'd, by being compar'd with the small.

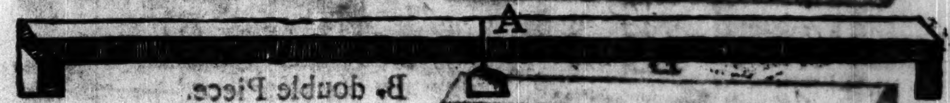
From which it may be observ'd, that the Vender's Advantage is to sell his Timber in as many Parcels as he can, and also whensoever an Estimate is to be put upon one single Piece, or upon a Quantity whose Contents are near equal, an Abatement ought to be made of about 5 *l. per Cent.* in order to make the same agree

with

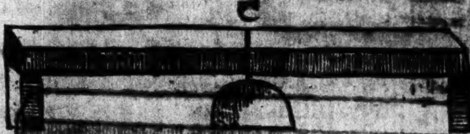
with the following Tables, which are design'd for a Quantity, according to the common Custom of Meeting.

From such Considerations, and some others which will occur, may be found the Value of every individual Piece of Timber in a Ship, and the whole be more nicely adjusted than has ever yet been done. For 'tis plain from what has been already said, that if the Hulls of two Ships be built in all respects similar to each other, the one 216 Tuns, and the other 1000 Tuns; if that of 216 Tuns be worth 6 *l.* 10 *s. per* Tun, then that of 1000 Tuns will be worth 10 *l.* 16 *s. per* Tun. But two Ships of those Burdens must not be in every respect similar consequently, nor directly adjusted by such a Method, without farther Consideration. However, if the Value of the whole Ship be so nearly comparable to a Surfolid, no doubt but the Value of the Parts are so likewise; the Difference therein arising chiefly from the different Quantity and Shape of Timber, in the one more in proportion than in the other, tho' that Difference is but small.

A. half as strong as B. by reason of being of double Length, and of equal Bigness.



B. bears twice the Weight of A. and of equal Bigness.

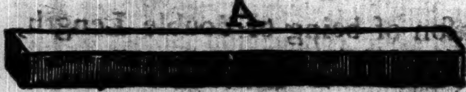


C. twice as big as B. and bears 4 times the Weight.

D. three times as big as B. and bears 9 times the Weight.

E. 4 times as big as B. and bears 16 times the Weight.

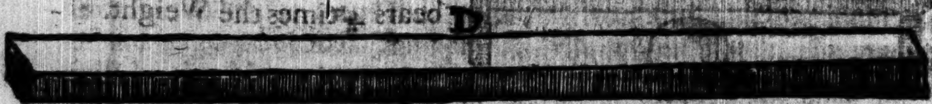
F. equally as big as E. but being of double Length, bears but half the Weight of E.



A. single Piece.

B. double Piece.

C. Quadruple Piece.



D. an Octuple Piece to A. and of 16 times the Value to A.

An Estimate of the Value of Oak Timber, as 'tis suppos'd to be worth in divers Places, serv'd to the Place of Business free of all Charge to the Manager.

Straight. Meeting one with another.	Straight. No Piece under Content.	Straight. No Piece under Length.	Straight. No Piece under Top end.	Compass. Meeting one with another.	Compass. No Piece under Content.	Compass. No Piece under Length.	Compass. No Piece under Top end.	Rate per Load.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	l. s. d.
240				192				3—17—11
235				188				3—17— 4
230				184				3—16— 9
235				180				3—16— 2
220				176				3—15— 7
215	56	26	13	272	37	17	12	3—15— 0
210				168				3—14— 4
205				164				3—13— 8
200				160				3—13— 0
195				156				3—12— 4
190				152				3—11— 8
185				148				3—11— 0
180	48	24	12	144	32	16	11	3—10— 4
175				140				3— 9— 8
170				136				3— 9— 0
165				132				3— 8— 4
160				124				3— 7— 8
155				125				3— 7— 0
150				120				3— 6— 3
145	40	22	11	116	27	15	10	3— 5— 6
140				112				3— 4— 9
135				108				3— 4— 0
130				104				3— 3— 3
125				100				3— 2— 6
120				96				3— 1— 8
115				92				3— 0—10
110	32	20	10	88	22	14	9	2—19—11
105				84				2—19— 0
100				80				2—18— 1
95				76				2—17— 1
90				72				2—16— 1
85				68				2—15— 0
80				64				2—13—10
75	24	18	9	60	17	13	8	2—12— 7
70				56				2—11— 4
65				52				2—10— 1
60				48				2— 8—11

55				44				2—7—6
50				40				2—6—0
45				36				2—4—4
40	16	16	8	32	12	12	7	2—2—8
35				28				2—0—11
30				24				1—19—0
25				20				1—16—7
20				16				1—13—9
15				12				1—10—8

An Estimate of the Value of Knees, none being under the following Contents; ⅓ being Raking, and ⅔ Square.

Contents.	Meeting.	Rate per Load.
Feet.	Feet	l. s. d.
8	36	5—10—0
7		5—6—0
6	27	5—0—0
5		4—14—0
4		4—7—0
3	14	4—0—0

An Estimate of the Value of Beams converted, &c.

Length.	Square.	Rate per Load.	Value of each.
Feet.	Inches.	l. s. d.	l. s. d.
44	—	9—10—0	18—10—0
43	18—	9— 7—6	17—16—6
42	—	9— 5—0	17— 5—0
41	—	8—18—0	14—12—0
40	17—	8—17—0	14— 1—0
39	—	8—15—6	13—10—0
38	—	8— 8—0	11— 5—0
37	16—	8— 6—6	10—16—6
36	—	8— 5—0	10— 9—0
35	—	7—16—0	8—10—0
34	15—	7—14—0	8— 3—0
33	—	7—12—0	7—16—0
32	—	7— 5—0	6— 7—0
31	14—	7— 2—6	5—18—6
30	—	7— 0—0	5—12—0
29	—	6—13—0	4—10—0
28	13—	6—11—6	4—06—0
27	—	6—10—0	4— 2—6

An Estimate of the Value of Oak Plank.

Thickness.	Meeting in Length.	None under — Length.	None under — Breadth top end.	Rate per Load.
Inches.	Feet.	Feet.	Inches.	l. s. d.
	32			6—11—0
	31			6— 9—0
4	30	23	12	6— 7—6
	29			6— 6—0
	28			6— 5—0
	27			5—11—0
3	26	20	11	5— 9—6
	25			5— 8—0
	24			4—13—0
[illegible]	23	17	10	4—12—0
	22			4—11—0
	21			4— 2—0
1½	20	14	9	4— 0—6
	19			3—19—0

An Estimate of the Value of Oak Treenails.

Length.	Diameter.	Charge of making.	Value of the necessary Wood.	Rate per Thousand.
Inches.	Inches.	s. d.	l. s. d.	l. s. d.
36	2—0	30—0	10—10—0	12—0—0
30	1—8	21—9	6— 3—3	7—5—0
24	1—6	15—0	3—10—0	4—5—0
18	1—4	9—9	1—12—9	2—2—6
12	1—2	6—[illegible]	0—14—0	1—0—0

AN

ESSAY

UPON

Marine Architecture.

ARCHITECTURE is a Branch of the Mathematics founded upon Geometrical Precepts, and is threefold: *Edification*, or the Art of building Houses; *Gnonomics*, or *Dialing*; and *Machination*, or the forming Machines or Engines.

Dr. *Harris* divides it into Two Principal Parts, Civil and Military. In a well built Fabric should be consider'd; first, Solidity, Convenience, Beauty; then Order, Disposition, Proportion, Decorum, and Oeconomy; and these Eight are said to be the necessary Properties of Architecture.

Solidity implies the Choice of a good Foundation, and good sound Materials to work with.

Convenience consists in so ordering and disposing the Parts of an Edifice, that they may not hinder or embarass one another.

Beauty is the Agreeableness and Harmony of the whole.

Order giveth each Part of the Building a convenient Bigness, whether consider'd apart, or with relation to the whole.

Disposition is the due ranging of all the Parts.

Proportion is the Relation between the Whole and its Parts.

Decorum, or Decency, consists in composing the whole Fabric according to the Rules of Art.

Oecono-

Oeconomy teaches the Architect to consider the Expences he is to be at, and the Quality of Materials at or near the Place of Building, to measure right, *&c.*

Now those Properties consider'd, and well understood, will qualify a Man for a compleat Architect. But the present Design is only to make a small Essay on Marine Architecture, or the Mechanical Part in building Ships. For several famous Writers having been very industrious to demonstrate and set forth the Art of building and adorning other sorts of Fabrics, both Civil and Military, which have all a Share in the aforesaid Qualities, and agree exactly to the 5 Orders of Architecture, *viz.* the *Tuscan, Doric, Ionic, Corinthian,* and *Composite,* not to mention what Care and Diligence have been taken in other Arts to compose the necessary Parts which may any ways assist or forward young Beginners) I was concern'd that Shipwrightry should be utterly neglected and despised, tho' of such great Use; nothing being said of that, except it be to render it difficult, and lessen its Esteem, and to put all Mankind out of love with its Study, tho' it so far exceeds several other Arts and Sciences, that a proper and regular Ship cannot be composed or built, without making several other Sciences subservient to this; as Arithmetic, Geometry, with the Knowledge of the Laws of Motion, and the different Increase between Rest and the greatest Motion, as also how Bodies gravitate; and to order the Equippings, the Experience whereof is the noblest Part, without which all the rest would be but insignificant. But he that has acquir'd both the Theory and Practice, makes an accomplish'd Shipwright.

And since I never met with any Essay for building and equipping Ships, I shall endeavour to deliver my Opinion in this Noble Art in as plain a Method as possible; which Attempt, tho' perhaps it may expose me to Censure, I'll rather run that hazard, than not contribute my best Endeavours to serve the Public in so useful a Design, which I shall prosecute without any farther Apology.

My first and chief Reason that induc'd me to this Attempt, was to detect the Ignorance of some, who, not any ways concern'd in this Art, pretend to lay down its Rudiments, and style themselves compleat Masters of Ship-building, without having the least Insight of what they pretend to. The second Reason was to instruct those that have only the Theory, but are utter

Stran-

Strangers to the Practice, since such Knowledge is very superficial, without the Mechanical Part. And the third and last was to inform the young Practitioner in the Method of Work.

In the Prosecution of this Design I shall first consider the *Solidity*, or erecting a Ship on the Launch, and launching her from thence.

Secondly, the *Oeconomy*, or providing Materials at or near the Place of building; and to measure right, without which Knowledge the Architect had better forbear building, as has been frequently experienced.

The *Disposition*, or Rules for fitting each part of the Frame agreeably and proportionably in every respect, follow in the next place.

Fourthly, the *Conveniency*, or Contrivance of the Cavity, that every Part may be of proper Use to each other.

And lastly, *Beauty*, or to set out, garnish, and render the whole Fabric so agreeable, as to appear pleasing to the Spectators.

And these Five are the necessary Observations, which ought to be considered in the Building and Equipping that Noble Machine.

SOLIDITY.

ACceleration of the Descent of heavy Bodies was first discover'd by *Galilæus*. Sir *Isaac Newton* has also made it very intelligible in his second Laws of Motion; and therefore any that are willing to be curious in that Subject, may have recourse to those Authors. For something of that Nature ought to be consider'd by every Master Builder, before he can pretend safely to erect a Ship on the Launch, in order regularly to lower her from thence. For Launching, or lowering a Ship into the Water, has not been always so nicely manag'd as it ought, it having been observed, that divers Ships have stood fast on the very Place they were first erected, tho' some Hundreds of Men have endeavour'd by all Means to move them from thence. Others have not given warning, but before they could be possibly clear'd of their Shores, they have run with such Precipitancy, that nothing could stop them, endangering not only the Workmen, but also the

the too curious Spectators; and why such Variety in launching has happen'd, is yet a Paradox to most Men.

Palladio, and several other Architects, give their Opinions concerning Foundations, and proving them, with the Dimensions they allow for building, directing the Foundation to be ⅙ of the Height of your Building, and to examine whether the Ground is not foundrous, by Digging or Boring, and if any part should be worse than the other, then to drive in Piles ¼ of the Height of your Building, and that the Platform be exactly level, that the Weight may equally affect the Foundation.

But this is in House-building, where the Case is foreign to our present Design. For our Business is to erect such a Building, which is to be removed from Land to Water, where the least Defect in such a Platform may be of great Detriment to the Fabric, not only in Launching, but in Building the same.

As to the direct Situation, it cannot be absolutely determin'd, because of the Variety of Places made use of for that purpose; nor to the exact Angle of Declivity, because the Draught of Water will be always various, as well as the Foundation. For if the Ground should be defective, and there be Water enough to receive the Ship, the swifter she goes the better, to carry her over such a defective Place; but if the Ground be firm, and but shallow Water a-stern, then the easier she goes off the better, for preventing her plunging too much, and striking the Ground.

In the Figures A. and B. may be seen the Advantage or Disadvantage which will accrue in the different Situation of Launches. For supposing the Center of Gravity to be in the Point *a*. D A C being the Horizontal Line in the Figure B. and A. *a*. B. perpendicular to the Horizon, tending towards the Center of the Earth, to which all heavy Bodies would incline, were they not stop'd, the absolute Pressure of this Body is perpendicular to the Horizon, and end-ways it would be moved as easily towards D. as towards C. And was this Ship to be lifted perpendicular from D. A. C. she would require an external Force equal to the Weight of the whole Ship, and what she has in her; but if she was only to be moved or drawn on the Plain D. A. C. her Motion would be with the same Facility towards D. as towards C. that the requisite Force would not be much above half what would be requir'd to lift her wholly from the Plain D. A. C.

In

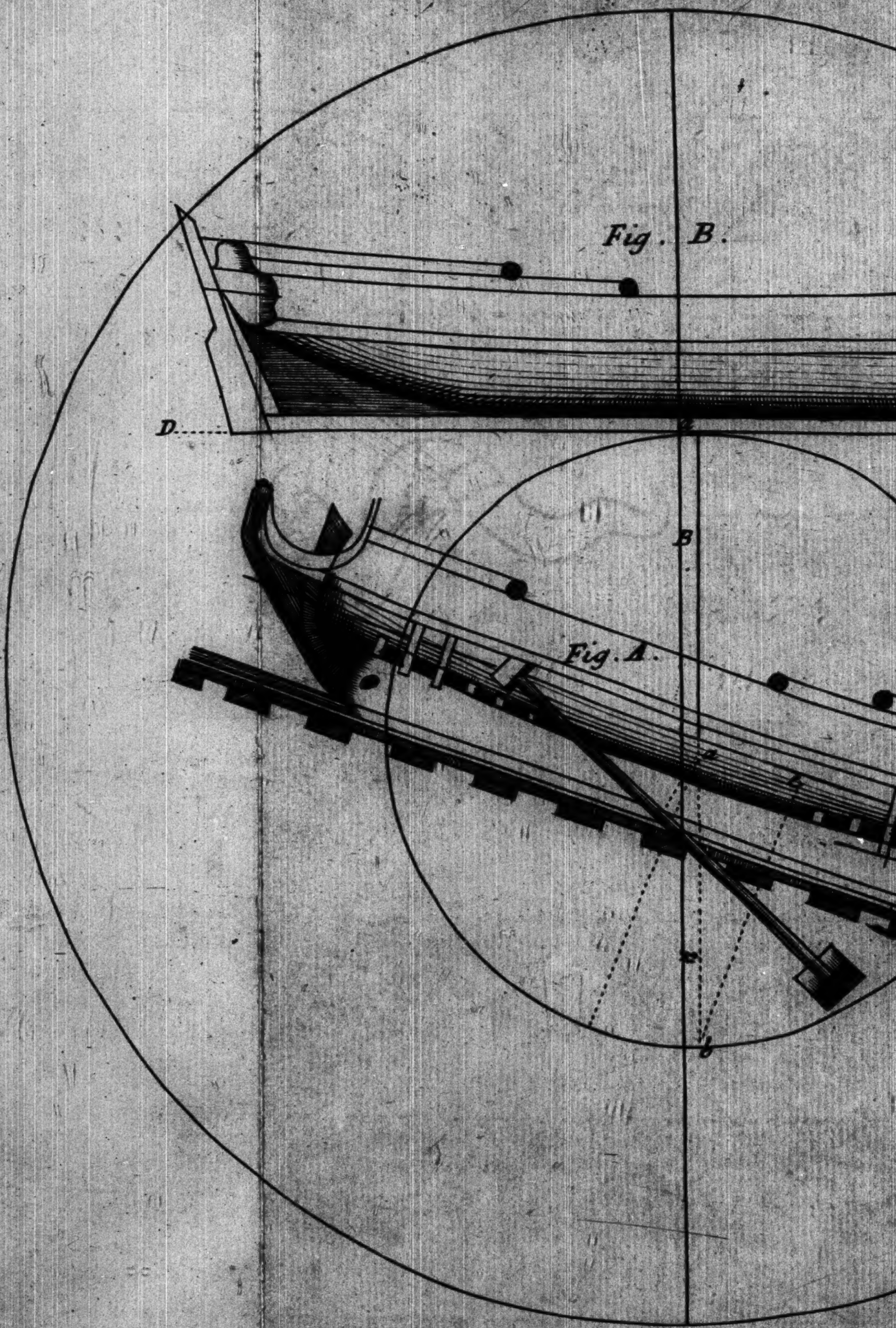
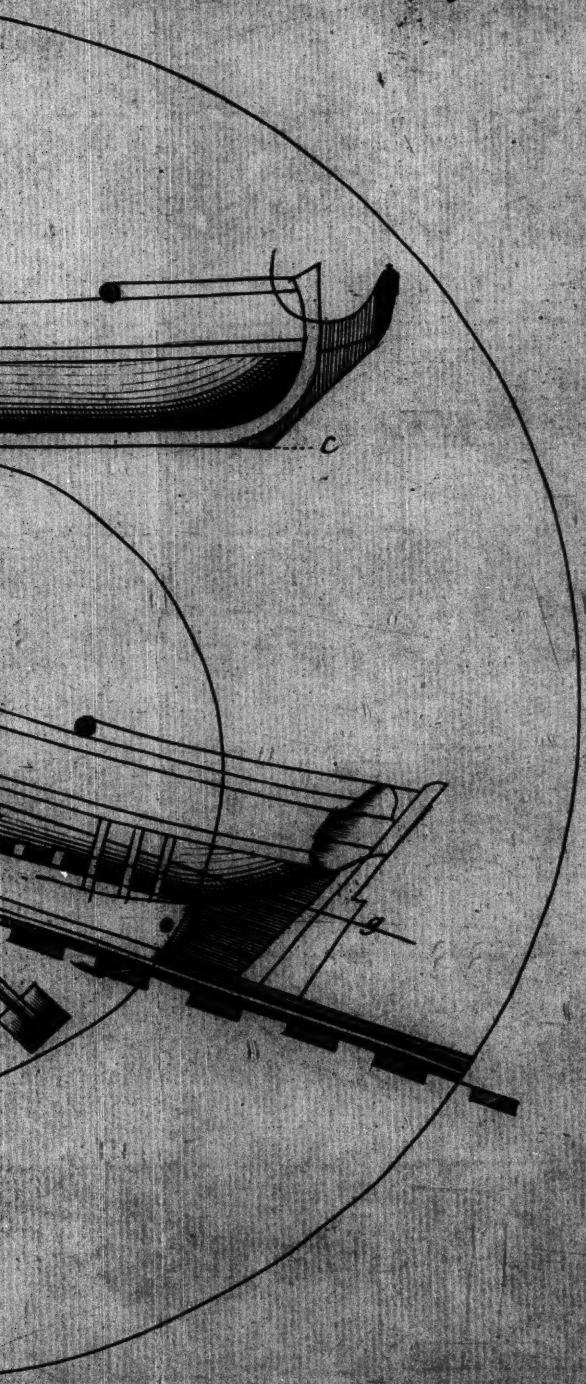


Fig. B.
D
B
Fig. A.
a
b
b


c
g

In Figure A. you may observe, that A. being a Center of Gravity, *a. b.* perpendicular to the Horizon, *a. c. b.* the Angle of Incidence made by this Situation of the Ship, and *b. c.* the Sine of the Angle of Incidence, the absolute Motion is according to the Line *a. b.* but the relative Motion to *a. g.* Therefore her Motion at first setting off in this Situation, will be to the Motion of the other in that Situation, as *a. b.* is to *a. g.* that is, A. will be so much easier moved than B. according as the absolute is to the relative Motion: But after the Motion A. is acquired, it will increase in A. in a much greater Disproportion than when it began, as may be observed in the Launching of several Ships, where Launches are variously situated.

Now the Curve of the swiftest Descent of any Body, or that in which any heavy Body descending by its own Gravity should move from one Point to another in the shortest time, is set down as a Proposition in Mr. *Harris's Lexicon*; and therefore it will be no hard matter to pitch upon the most convenient Situation for launching or lowering any Ship into the Water.

The Situation being duly considered, the next thing requisite is to fortify and make provision to bear the Ship's Body, and also for laying the Bulge-ways on; which is done first with large Pieces of Timber, according to the Magnitude of the Ship, which are called Ground-ways, being *c's* in the Figures A. B. Upon those Groundways lie Blocks of hard knotty Stuff, to raise your Foundation, upon which you lay other Blocks called Splitting-blocks, of the freest Timber that can be got, for the Conveniency of cleaving out again, when you are ready to launch, being *e's*, on which you lay the Keel. When that is trim'd, scarf'd, and rabbited, mind to set it very streight and level, letting it into the Splitting Blocks an Inch and half, which will be a Stop to confine, and keep it right in its Place.

When the Keel is put in order, set off the exact Length forward and afterward, from the Observation of the rising of the Keel, by Shipwrights called the Touch, or Place where the Keel's upper Part ends to be streight.

After the exact Length of the Keel is set off, scarf the Keel to the Stem, and tenant the Post into the Keel, raising the Stem and false Stem (or Apron) together, if it be a small Ship, and also the Stern-post, with Transoms and Fashion-pieces join'd together. But if it be a large Ship, then only the Post, or perhaps

hips upper and lower Transom, with such a regard always to the Weight, that the Purchase and Security may be an Overballance for it, that you hazard neither Men nor Materials. Which Caution ought to be universally observed throughout your whole Work.

Let the Stem and Stern-post be exactly set out of winding with the Keel, and also perpendicular, which is done by marking middle Lines on them. The Transoms ought to be level, but especially the Wing Transom, securing all very well with Shores, which ought to be plac'd on Timber Foundations, called Sholes, and well nog'd or trig'd.

In crossing the Floor-timbers, Care ought to be taken not to tear the Rabbit of the Keel. Get on first the Frame-timbers, which in some Ships is every fourth, and in some every third; but in crossing the Floor-timbers, every other Timber is commonly put on, and bolted thro' the Keel. Then hang up a Ribbon at the Floor Sirmark, and if the Floor is fair, or rises gradually, nail that Ribbon, and shore it with very able Pieces of Timber, sufficient to bear the Weight that may be put upon them. Observe to level the Floor very exactly, since it is the first and principal Seat which bears the Ship; and then nog all the Shores very secure, fill in all the Floor-timbers, and get on the dead Wood afore and abaft. Let in all the Half-timbers, and then get in your Kelson. Observe to score the Kelson on all your Floor-timbers, and scarf it, and bolt the Kelson through every other Floor-timber, and the Keel. The other Floor-timber is also bolted in the Keel.

The Fashion is to frame every third, or every fourth Timber, that is, to fit or join all the Foot-hooks and Top-timbers together, if it be a small Ship; but if a large one, then all the Foot-hooks, as high as the Breadth Ribbon; and observe to join the Frame-timbers very exactly, and true to the Mould. Get a Ribbon on at the Breadth Sirmark, after such a manner, if it be possible, that you may get on one Wale before you take it off again. When you have cross-pal'd these Frames, shore the Ribbons, laying Sholes under; then level the Sirmarks, and set the moulding Edges exactly perpendicular from the lower Edge of the Keel. For since these Breadth Sirmarks are the second Seat of bearing, whether they are consider'd apart, or with relation to the whole Frame, 'tis certain if the Floor Sirmarks and Breadth

Sir-

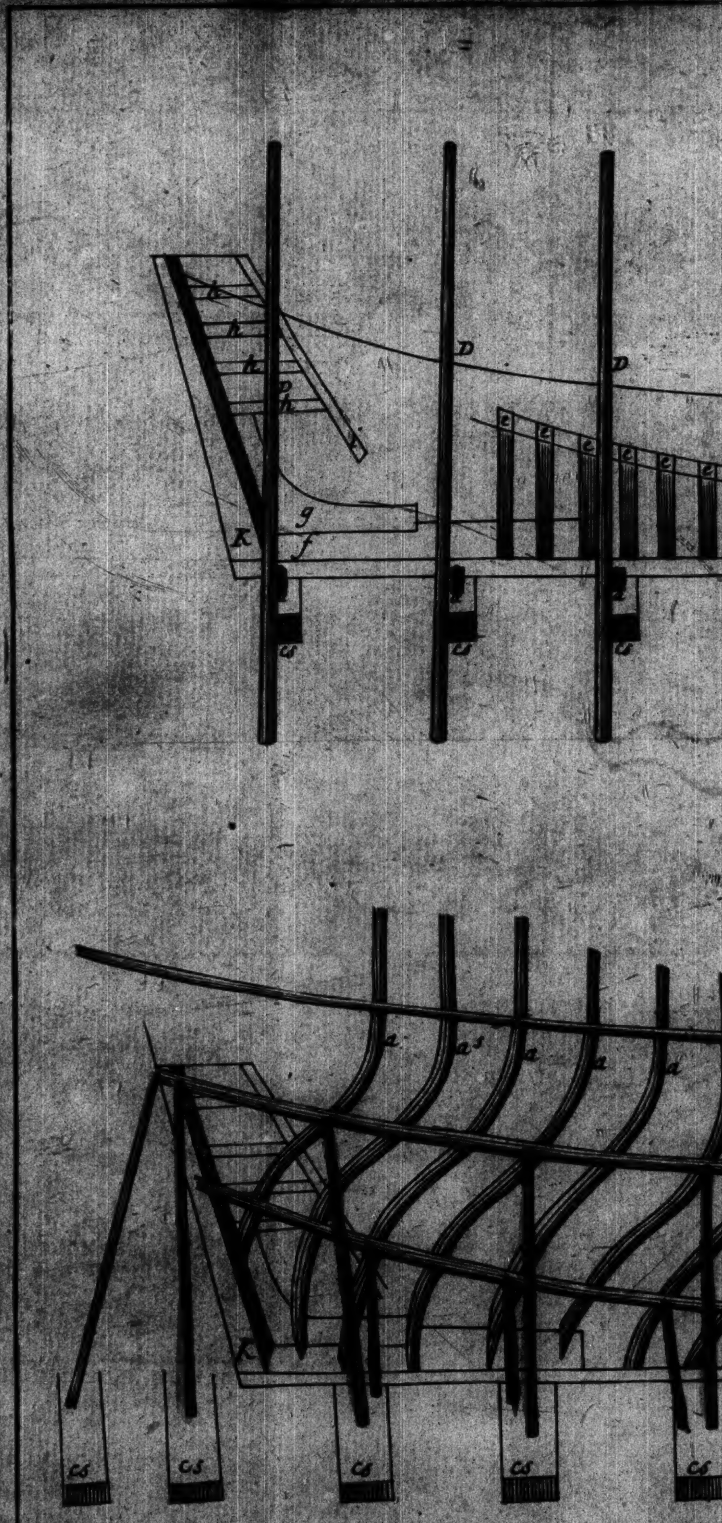


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Fig. A.

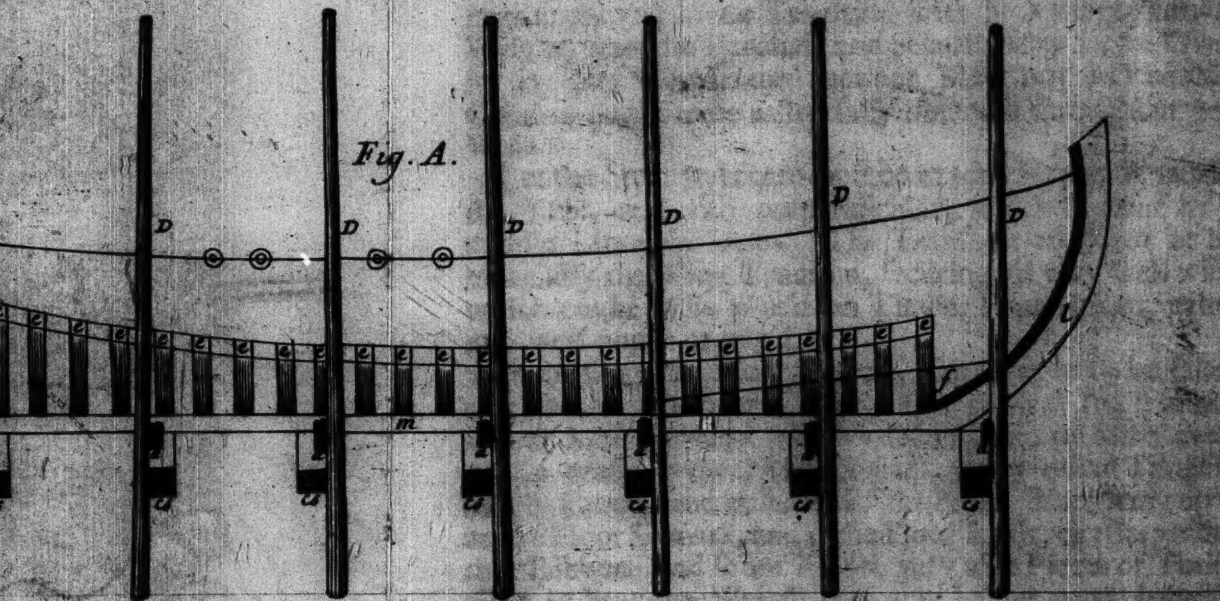
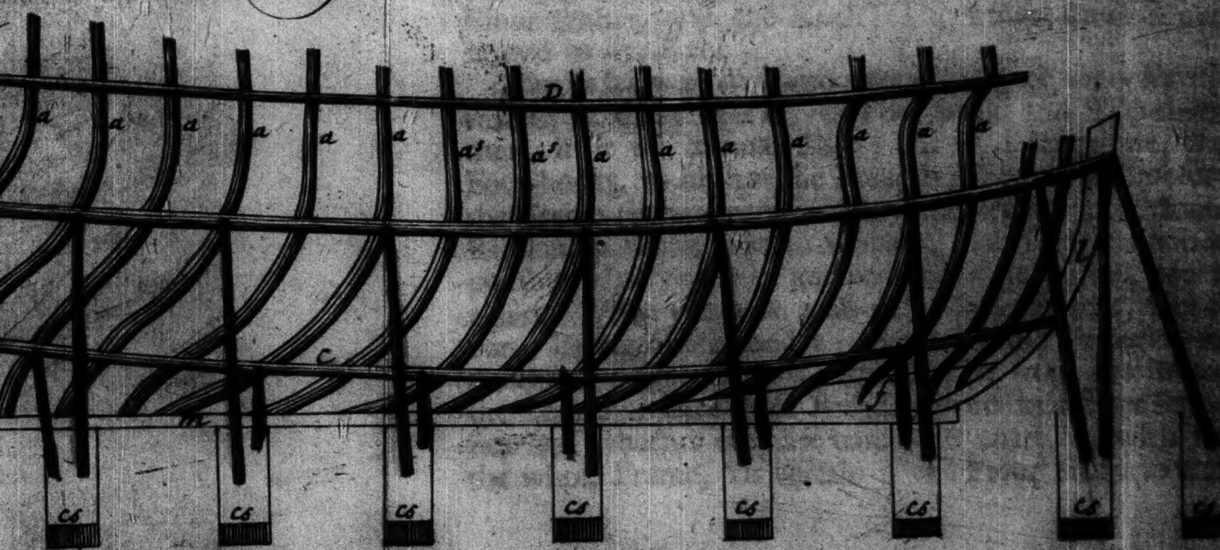


Fig. B.



Sirmarks be not very well level'd, you mar the whole Work. For let your Design be ever so good, without a due Caution here, you will certainly have the Misfortune of a lapsided Ship, that is, one whose Radius's are not equal from the Center, but her Perpendiculars and Parallels declining from the Horizon. And was such a Ship hung by a String (or other Device) from the Middle or Center, one Side would overballance the other. These Considerations necessarily occur in relation to *Solidity*.

Fig. A. is the Floor-timbers, *e*'s placed on the Keel. P. is a Ram-line made fast on the Stem and Stern-post, and weighed by some Device or other to steddy it. D. are Standers to raise the Stages. *f*. is the Dead Wood afore and abaft. *g*. the Knee on the Dead Wood. *h*. are Transoms. *i*. the Fashion Pieces. K. the Post. *l*. the Stem. *m*. the Keel. The Red are Splitting-blocks.

Fig. B. resembles the whole Frame-bends, which are *e*'s. The Red are Ribbons. *c*. the Floor. D. the double Depth Ribbon, or Ribbon at the Sirmark of the Top-timber. The Yellow are Shores at the Breadth; and the Brown are Shores at the Floor Sirmark.

OECONOMY.

IN Ship-building this Part is also absolutely necessary, without the Knowledge of which 'tis in vain to attempt it, as has been too well experienced by several broken Ship-builders.

And indeed 'tis almost impossible to lay down a general Rule in such a Case, since the Opinions of Men in this Science are so various, that one may safely affirm, out of the vast number of Shipwrights that are in *England*, there are scarce two of one Opinion; so that our Occupation, altho' so very useful, is no other than a Notion. For was it demanded of our most celebrated Shipwrights, what the Body of a Ship is, the Answer would be, An irregular confus'd Body, without being able to give either the Genus or specific Difference. Irregular they certainly are, which mightily retards this second principal Part of purveying for Timber. For if Ships were regularly form'd, by some Geometrical Curve or Figure, Timber and all other Utensils might be as well provided for them, as for building any other Fabric. From which regular Shape we might gradually proceed in the exact

Calculation, not only of the Hull, but of every particular part of equipping this Machine, in such an easy Method, that not only the Character of accomplish'd Shipwrights might soon be attained, but it would likewise be beneficial to every Man concerned either in building or equipping Ships. For most Ships, but especially small ones, might be built, and with as great Exactness, with half the Timber as is now customary to be put into them. Which may be objected as a Hindrance to the Vendors; but the Workman will receive a Benefit by it. For it will be done by even and fine drawing the Materials, which will take up more time, and be likewise a Benefit to the Owners, besides an Advantage to the Ship's Motion.

The next Advantage which will accrue from regular Bodies, is to convert Timber to its various Uses in the Woods, that the Charge of Carriage may be for none but what is really useful. For since the Product of converted Timber from that which is River-squar'd, is not above $\frac{1}{3}$; and abating the intrinsic Defects in Timber, there is not above $\frac{1}{6}$ that really comes to Use, and goes to Sea in the Ship; was this regular Method universal, Radius's might be stated, and necessary Calculations made for every particular Ship, Bark or Boat. Which Caution well minded will prove beneficial to the first Proprietors of our *English* Timber. The Price of converted Timber, to that which is truly rough-squar'd, has been observed to be as 3 to 1; yet this additional Price may be made up by the Advantage the Buyer has, in seeing the Inside of his Timber, and discovering the Defects, and also the Waste the Vendor receives by the many Conversions. Wherefore converted Timber (according to this Method) is cheapest, provided there be a general Use of sound and serviceable Timber proportionable to the Bulk it bears. The Defects of Timber are various, but 'tis chiefly owing to the Barrenness of the Soil; as in loose and broken Ground the Timber is generally shaken, which is a common Defect, and very pernicious. A strong Clay commonly produces sound Timber. Lopping of Timber often causes Putrefaction.

In converting Timber, great Care ought to be taken to preserve it as large, and also as circular as possible, from a Consideration of the Value of compass Timber. Observe also a Medium in extracting the Sap, by reason of the Charge in often Conversion.

The

The Custom in converting Timber is to make the 4 Wanes equal to 2 Squares, as in the Figure A. The Wanes being 1 1 1 1, and the Squares 2 2 2 2. So that four 1's are equal to two 2's; which is really the Truth for squaring Timber Trees: and if it be not so squar'd, the Detriment may not be only in the false Measure, but also in hiding or covering the Defects, which would appear, was the Timber truly squar'd: For it may as well be vended round as it is squar'd, by the Custom of some Places.

This Method is very exact, and in most Places a customary Strike between Buyer and Seller. But perhaps some may object that the But-end will be reduced, which mars the crookeding of the Piece. However that's but one way, for it may be served in round as was said before, and the Price proportion'd accordingly.

And this Custom may be made universal without Prejudice or Disadvantage to any; for it will be both advantageous to the Carriage and Stowage of sound Timber, and that which is not so.

Such Timber from 4 Inches to 1 Inch and ½ thick, is called Plank, which is for covering the Timbers, being calked to keep the Cavity dry, which is always converted to its various Thickness, and generally in the Wood or Coppice. But Edge-ways it is not so nicely converted as it ought to be, since it's seldom or never known that Planks are wrought above 15 or 16 Inches broad on the biggest of our Shipping, in the broadest Places; and in other Places only 11 or 12, except it be Aft three or four Strakes of Elm to raise up the Run of the Ship.

Now if 4 Inch Plank be but 12 Pence *per* Foot, and such Plank converted two Foot broad, and served into the Yards so, and the necessary Plank but 16 Inches broad, then there will be ⅓ Waste, and 1 Shilling in 3 lost. But perhaps for this Waste it may be answer'd, that there is Wood to work on, without which you would be at a loss to plank any Ship's Bottom. Which is no other than a meer Chimera, since 5 Planks in 6 on any Ship's Bottom are perfectly streight, and most of parallel Breadth, and where they are not streight, they might be made so, were proper Shapes and Methods consider'd. But provided the Case was other-

otherwise, it would pay a treble Expence to make Models, to procure Plank to a better Advantage than usual.

And this Hint would prove very beneficial in transporting Plank by Sea. For if East Country white Crown'd Plank, which is the best, be worth 20 *l.* 12 *s.* *per* Load, or 2 *s.* 9 *d.* *per* Foot of 4 Inch Plank, and this only superficial Feet; then it's really more valuable, and is brought to the Place of Use dearer by the Pound than the best of our stall'd Oxen. And if so, which may be soon known if examin'd, what good Husbandry is it to shape it before it be moved from its native Soil.

But perhaps the Proprietor may object, that by doing so his Timber will be cut to waste, besides that the Charge of Conversion will be greater. But on the contrary it may be easily proved, that the Proprietor's Gain will be advanced something, and the Builders or Owners of Ships considerably.

But here is yet a more necessary Consideration, Whether the Product of our own native Soil is not sufficient to furnish us with such Goods at a cheaper Rate? If so, the Encouragement may as well be given to our own Country-men. However, this Point cannot well be solved without taking a View of our stately Oaks, which grow in divers Parts of her Majesty's Dominions, tho' perhaps somewhat distant from the Water; the Owners of which had doubtless rather sell their Timber to some Advantage than to let it stand and perish.

Indeed it must be own'd, that some of the best sort of East Country Plank is very flexible, and consequently very proper for working up our foremost and aftermost Parts of the Ships; but then where one is brought that's very good and serviceable, there are 9 or 10 which are either shaken, druzy, worm-eaten, or full of rotten Knots. And 'tis really very strange to see what ill Management there is in dealing for such foreign Goods. For certainly Timber of our own Growth must have the Preference in all the aforesaid Quantities, even after it hath stood so long, that Age has made it very pliable, which is a necessary Consequence in Timber that is old, and past the Time allowed for Growth, since then our Plank is as durable as any other, altho' in its full Strength. And could it be so order'd, that all our round Plank bent about a Ship was so naturally, it would be much stronger than that which is forc'd. For first, they are wrung by bending, for the Grain is undeniably strain'd, if not broke.

Besides,

Besides, the Fire over-heats, and dilating the Pores, the Water is received, which causes Mouldring and Putrefaction. So that this Method cannot be called Burning or Boiling, because it partakes of both, and undeniably the hot Water is more beneficial than the Fire.

But the principal Defect is, in the irregular Shapes of Shipping, since after all our Practice, we can't pitch upon exact Models. For if we could, an indifferent Purveyor would be able exactly to know what Sort and Quantity of Timber, would be requisite to build any Ship. This unnecessary Custom therefore of laying such large Quantities of useless Timber to perish, may be left off, and Timber may be cut and provided as the Service requires, only with this Proviso, that 2 or 300 Load of useful Timber, cut at the right Season of the Year, be laid in Bank, one upon another, that there may be no Want. This Part of Marine Architecture ought not to be slighted, since 'tis the principal Part of *Oeconomy*.

Tho' there be several other material Branches, as the Masts to be well and proportionably made, the Rigging curiously wrought and placed, the Sails truly cut and set to the Wind (observing that the evener any Material is wrought, the stronger it is with less Substance) and the Iron Work very dexterously perform'd; yet the Timber and Plank being most material, and the Skill of providing them more properly the Business of a Shipwright, the rest will be referr'd to another Consideration.

DISPOSITION or HABITUDE.

THIS part of Marine Architecture being very extensive, would require abundance of Pains and Time to perfect it. For to compose a Ship, and her Equipping, so proportional and agreeable in every respect, that each Part may answer its end, was scarce ever yet thought on. As first, so to form the Hull of a Ship, as to be capable of the swiftest Motion; then to equip her by the truest and exactest Method, that all her Masts, Yards, Sails and Rigging, may equally affect the Hull; and lastly to lade her answerably to the rest, or as Mariners term it, truly to trim her, will be found to be a very hard Task. I say, to build

such

ſuch a Veſſel, with all theſe Properties, as to ſail ſwift, to be eaſy and ſteddy in the Sea, to ride well and faſt at Anchor, to be built cheap, and to carry a great deal of Sail and Lading, to be ſtrong, convenient, and beautiful, would be a noble Performance.

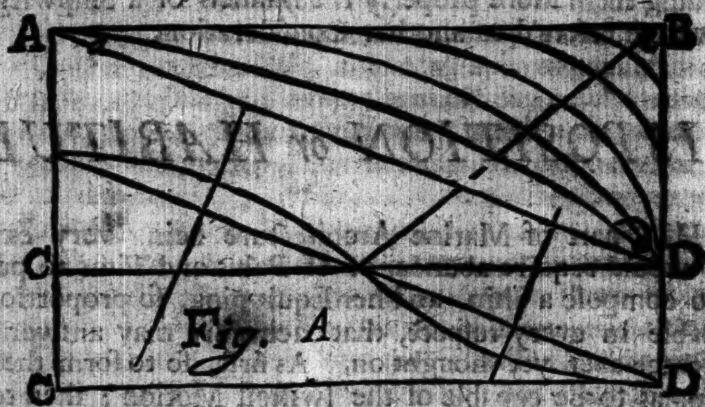
But perhaps this may be thought altogether impracticable. And ſhould a Principle be advanced on which a Ship like this in every reſpect might be built, it would probably be oppoſed without ever examining into the Truth of it.

And 'tis not unlikely the firſt Objection might be: After ſo many famous Builders have been ſucceſſively endeavouring to exceed one another, how comes it to paſs that a Man, who never experienc'd the building of one Ship, ſhould hit upon ſuch an Invention?

A ſecond perhaps, that Experiments are chargeable, and Projection is often only with a deſign to amuſe.

To which may be anſwer'd, That our daily Practice in Shipbuilding is nothing elſe but Project, and grounded on no manner of Principle.

Beſides, it's altogether impoſſible to build the 100 Part of the Ships that have been built, without finding the direct Shape: For there can be no other regular Body built by one Rotation, than what is form'd tranſverſe ways between a Cone and a Cylinder, according to the Length and Breadth propoſed.



In Fig. A. the rectangled Parallelogram A. B. C. D. may be ſuppoſed to be the extream Breadth of the Ship, and half the Length, whoſe Rotation would make a perfect Cylinder, which would

would be the bluntest Fashion in which any Ship could be regularly form'd, according to the Breadth and Length assigned. A C D is a Right-angled Triangle, by whose Rotation round an Axis a Cone would be formed, which on the other hand would be the acutest Fashion that any Ship could be made in, provided she it not shaped with Points of Inflection. So that all the Lines which are drawn in the Right-angled Triangle *a c d*, may be termed Intermediums, or Lines by which Bodies may be formed, to find out the best for Motion or Swiftness.

The next retarding Faculty may be the over weighing Ships with Timber, since 'tis allow'd by good Authors, and indeed seems very likely, that the Gravity of the Body, and Resistance of the Medium, causes a Cessation.

Sir *William Petty*, in his Book of *Duplicate Proportion*, says, that a Ship of 400 Tuns equally as strong as one of 50 Tuns, ought to have 16 times as much Timber. Which Maxim strictly examin'd will put Shipwrights upon finding a new Scheme for scantling either Boat or Ship.

A First Rate Man of War to a Sixth Rate is as 7 to 1; for which reason she has 7 times as much Timber. But according to Sir *William Petty's* Proportion she ought to have 14 times as much. So that either the First Rate is under scantled, or the Sixth Rate is over-timber'd. But finding the largest Ships are sufficiently strong, it must follow that the small ones are over-timber'd.

One Reason may be this, that the Sails of a First Rate are to those of a Sixth Rate but as 3 to 1. Wherefore the Power being but as 3 to 1, and the Weight as 7 to 1, the small Ship ought to sail twice as fast. But if they are either equally clean or otherwise, with an equal Number of their respective Sails set, their Velocity will be also equal.

But further, the cross Sections of these Ships at their main Breadths, being but as 4 to 1, and their Lengths double, so that the Body in the Water is as 8 to 1, it may be reasonably allowed, that the absolute Resistance of these Ships is as 6 or 7 to 1, as well as the Weight of Timber. From whence it will follow, that either the First Rate has but half the Sail, or the Sixth Rate twice the Timber she ought to have, to make them proportionable to each other.

And if it can (as I doubt not but it may) be easily proved, that a Sixth Rate may be built as strong, and performed as well every

way with half the Timber; the Benefit will not be only in that Prticular, but in the Masts, Sails, Rigging and Blocks. The Men will be also lessen'd, and every particular part of the Equipping reduc'd; so that three Ships will be then built for the Charge of two now.

But perhaps it may be expected, that such a Demonstration should be here laid down, which cannot possibly be done at once; but after I have gone through the *Conveniency* in Ship-building, I shall mention something of that Nature, and describe a Form to build a Ship of any Magnitude, in as proper a Method as any that has ever yet been attempted.

CONVENIENCY.

TO contrive the Cavity of a Ship, that it may admit of the due ranging and disposing of every thing therein contained to the best advantage, is called *Conveniency*.

Hence a Ship ought not to be too long for her Breadth, or too short for her Depth; but her Shape and Proportion adapted to the Use for which the Vessel is design'd, which also relates to *Disposition*.

'Tis certainly inconvenient, where the Breadth and Depth are not agreeable to the Length. For if a Ship be made of as good Service with 20 Foot broad as with 22, then the latter will have a Foot on each side to resist her Motion more than the other. Besides, extream Breadths will be in the Nature of Ballances, and will cause a Ship to rowl; which Disadvantage attends extream Depth.

Length beyond a due Proportion, will be as prejudicial on t'other hand. Altho' some of our preceding Master Builders have proposed Length as expedient to increase Motion, yet it has seldom answer'd; for if Ships are extream long, they ought to have a more than ordinary Allowance of Timber to make them equally as strong as short Ships. Besides, if the Solid of least Resistance be a blunt-headed Solid, extream Lengths will be useless to make cutting Bodies.

And these are the principal Points requisite to be considered towards compleating this Branch; but for the other Parts, they may

may be differently extended, according to the Use for which your Ship is designed; some Ships requiring to be deeper in the Hold than others, and perhaps that Depth may be spared out of the Height between Decks.

Observe that the Keel, Stem and Stern-post be convenient for the Parts that follow; as to bolt the Floor-timbers, Dead-wood, Transoms, hanging the Rudder, and fastening the Knee of the Head, if any, also Breasthooks and Steps of the Masts; that the Rabbets cut in the Keel, Stem, and Sternpost, be suitable, as well for the Planking, as to answer the Fashion of the Body in every respect; that the Stem be made fit to lay the Bowsprit in aloft, and to secure the Stay of the Main-mast; that the Scarfing and Over-launching of all the said Parts be duly considered, tho' to tenant the Stern-post in the Keel is not nigh so strong as it may be made by scarfing them, as shall be demonstrated; to carry up all the Timbers with equal Room and Space, that one Part of the Ship may exactly have as much Timber as the other, and not to continue them join'd in one Place, and 6 Inches asunder in other Places, but that after the Frame-timbers are up in their Places, and truly set, they may be parted without Prejudice, and equally spaced, as the Ship is planked; to have no Side-round-timbers, but exactly streight, except it should happen, as it often doth, for the Conveniency of putting them clear of the Ports, which is a material Point, and what ought carefully to be observed, otherwise you may be obliged to cut several good Top-timbers to make Port-holes, and put short Stumps in lieu of such good long Timbers.

Let your long Timbers be order'd forward after such a manner, that they may rake forward one after another, and take up as much Room and Space at the Head as at the Foot. Also turn or cant them forward, as much as possible, to save the levelling of the Timber, and that the Hawse-pieces may have room to have sufficient Scarph downwards. Observing also one and a principal Part, which is to make the Bows of the Ship exactly similar, carefully making Harpings equal, that the Foremast Timbers may stand at an exact Distance from the middle Line, and also from the Stem; which will cause the natural Tendency of the Ship to be direct, without inclining to one hand more than to another, and consequently will increase Motion.

So order the Beams, that they may pillar on the Floor-riders, to make Hatch ways neceſſary to lade and unlade. The Well is always about the Main-maſt, and ſo are the Pumps; but with this Caution (if they be Chain-pumps) that they may ſtand clear of the main Step, and have Room enough to reeve the Pump-chain. In a Man of War you make Proviſions forward for the Powder, and Gunner's, Boatſwain's, and Carpenter's Stores, with an extraordinary Regard that the Powder-room may be intire, and very carefully lin'd double, and well plaiſter'd with Mortar between, and due Conſideration to the Quantity and Quality of every Officer's Stores, that they may have neceſſary Apartments; to have Orlopes and Platforms of ſuitable Lengths and Breadths to coil the Cables on, part afore the Main-maſt, and part abaft; to have Apartments quite aft for the Bread, and next to the Bread Room, a Room for Oatmeal, Fiſh, Butter and Cheeſe; a Steward's room, Captain's Store-room, a ſmall Powder-room, Purſer and Surgeon's Cabin; and a Cock-pit for the Conveniency of Mens taking their Proviſion from the Purſer's Steward, and alſo a ſmall Slop-room. But if it be a Merchant Ship, then the Hold, or all below the lower Deck, is reſerved to hold ſeveral Commodities, according to the Voyage.

Upon the lower Gun-deck in Men of War there is an Apartment for the Gunner, called a Gun-room; it is for fitting and ſecuring all his ſmall Stores. Afore there is a Manger, which is ſecured to hold the Water that is received at the Hawſe-holes; which Place and the Gun-room are generally on board all Men of War above a Sixth Rate, tho' there are ſeveral other different Apartments according to the Pleaſure of the Commander, and the Magnitude of the Ship.

There ought to be always this ſpecial Remark in ſpacing the Beams of each Deck, that the Knees of each Beam may be placed clear of the Ports, that you may not be put to the Shift of uſing Dagger-knees, or thoſe that are crooked, which are ſeldom ſtrong, and more difficult to purchaſe than ſtreight. On the middle Deck, in Ships that have three Decks, the Furnaces are placed, and in two Deck Ships they are placed in the Forecaſtle; and alſo in all Ships which have Forecaſtles the Proviſions are there dreſſed.

The

The Bulk-heads ought to be fitted after such a manner, that they may be secure for a close Fight, and not hinder or embarass the securing the Masts, or traversing the Yards; but that every Rope requisite for haling or handling the Rigging, or Power that drives the Ship on her Passage, may be readily come at, secur'd, and fasten'd.

A due Consideration should also be had in fixing Blocks for the Main and Fore-sheets, as also for tacking the Clews of the Sail, and Blocks for the Clew-lines, Bunt-lines, Leetch-lines, Halyards, Bow-lines and Braces, and every other Rope that is requisite in sailing the Ship, to bring all the Purchase clear one of another; and that the Angles of Purchase may be as obtuse as possible, for the Facility of gaining the same with smaller Force; to have Channels fixed without board, of sufficient Strength, and well secured by Spurs or Knees, that the Channels may stand firm against the Impulse of Wind on the Masts, Rigging and Sails. There are Plates of Iron, called Chain-plates, fixed to the Channel-wales, and dead Edges bound by those Plates, wherein the Lanyards of the Shrouds are reev'd, and spread by the Channels. These Shrouds, with the Stays, are the Ground Tackling, the grand Security for the Masts, and ought as near as possible to be placed in a circular Position, that the Security may equally effect the Strain. Backstays or Topmast Shrouds are to be fasten'd down to the Channels, or Stools fixed for that purpose.

Conveniencies must likewise be made for hoisting in the Guns, Provisions, Boats, Anchors; to have Bolts to hook your Gun Tackles to, and Breechings, with an Eye-bolt to every Gun, to lash up the Muzzle; to have Stopper-bolts for the Cables, and Bolts to lash the Boats on the upper Deck; to have Bolts for the Top-tackles, standing Parts of the Sheets, Shank-painter Chains; to have Ranges, Kevels, and what Provision can be thought requisite for the more easy and handy securing and fastening the respective Ropes of every Sail and Utensil proper and convenient for working and ordering the Ship.

The most convenient Place for stepping every Mast has been found by Experience according to the Length on her lower Gun-deck, or the deep Load-mark Line. The Size has been also approved on by Practice, since Ships have often sail'd as fast with Jury-masts, as with their establish'd Equipping. Tho' several Writers say, that the Velocities are the Square Roots of the Power

that

that drives, or draws the Body, from which it should be a Quadruple Sail to cause double Swiftness. Hence, unless the Fashion is adapted to the Magnitude of the Ship, all our Art can be only allowed notional, and the safest way of Building and Equipping will be to go to Precedent, if there be any to be found. But this is a superfluous Caution, since 'tis very customary, that let a Ship be fitted never so well by one Hand, it will not suite the Temper of another.

Besides, the proper Business of a Shipwright is counted a very vulgar Imploy, and which a Man of very indifferent Qualifications may be Master of. Many have as mean an Opinion of it, as a certain Gentleman, who told one of our former Master Builders, that he had a Blockhead of a Son uncapable to attain any other Trade unless that of a Ship-carpenter, for which he design'd him.

Indeed the Business of Ship-building is of a large Extent, so that Men very meanly qualified may pass amongst a Crowd of good Artificers; but this is no Reflection upon it, that some unskilful Persons may be imploy'd, but an Argument of its general Use, since none can call themselves accomplish'd Shipwrights, without several distinguishing Qualifications. And certainly *England* may challenge the whole World for able Shipwrights and Sea Discipline.

I have a due Veneration for several Gentlemen in very good Posts for Management of Ship-building; notwithstanding I am well assured there are others well qualified, who have but very indifferent Encouragement. But I still hope that Truth may discover it self in mean Language, as well as a wise and honest Man in mean Habit.

Since 'tis absolutely impossible to shew the whole Contrivance of such a noble Structure, and the Parts requisite for her Use, on a Superficies, at one View, especially in so small a Plan: Therefore this first Figure A. is a Section of a Ship, having 3 Decks or Platforms for Guns, and only shews her Frame, containing, Keel *a*. Stem *b*, Stern-post *c*, Dead-wood *d*, Transoms *e*, Fashion-pieces *f*, Hawse-pieces *h*, and the Floor, Foot-hooks and Top-timbers, which Timbers ought first to be equally spaced, as may be observed. I mean by spacing, that according to the Magnitude of the Ship there be an Allowance made for two of the first Floor-timbers, besides a Vacancy between them for Air.

For-

Formerly the Method was to put the Ground-timbers, as Floor and Lower Foot-hooks, close together ; but it being observed to cause Putrefaction, and also prejudicial in over-scantling the Ships, it was left off.

But what materially occurs in this Section, is what ought chiefly to be minded in placing the upper Foot-hooks and Top-timbers, to put them clear of the Port-holes, to space the long Timbers forward equally, to make room for the Hawse-pieces, which ought to be well scarfed downwards, for Strength to the Bows. By Scarfing is here meant, to have a sufficient Length of Timber below the Center of the Hawse-hole *k*, or Center of the Strain ; but in other cases Scarfing may be taken for Splicing, or fastening one Piece to another.

Let the Top-timbers be placed as near as possible, to make the Sides of the Ports, that the Lashing-bolts for the Guns may be drove through the principal Timber, and that they may give Scarf to the Port-holes ; which may be done by marking the Port-holes on the Breadth Ribbon before the Ship is planked, *g n* being the Breadth Ribbon. And if it be found that the Timbers exact Place be in the Wake of the Port-holes, and that there be not room enough to move them otherwise, then get a crooked, or Side Round-timber (if you can) that will cast it self clear, altho' all Timbers are placed exactly perpendicular from the Keel.

The Ribbons *g* of any Ship may be understood as tacking the conjugate Parts of a Ship together, till they are all in their Places, and the Plank as transverse Parts ready to be brought on, and fasten'd to the Timbers or Conjugates with Treenails or Pins of Wood.

Fig. B. is a Section representing the Contrivance of cutting the Portholes and placing the Beams, which Ports and Beams are marked Red in the Section. The hanging Knees are placed in the same Position with the Timbers, being bolted both to the Beams and Timbers, for holding the Beams to the Sides. The Beams ought to be placed one between, and one under the Ports of each Deck, with this Caution, that the hanging Knee may be placed clear of the Ports, and the lodging Knees abaft the Beams forward, and afore the Beams abaft, for the benefit of making those Knees as much without a Square, or as obtuse an Angle as possible, for the Easiness of obtaining them. Besides, in not regarding the exact spacing of the

Ports

Ports and Beams, another Inconveniency happens, which is to have Dagger-knees.

The Beams ought to lie as near as possible under the Ports, to support the Reverse of the Guns when fired, and also to lie one exactly over another, that they may support each other with Pillars placed perpendicular; and the lower Beams are supported by the Bottom of the Ship, and that by the Water. Which Bearing of a Ship, as long as she is kept from the Ground, is as firm and easy as a House, or any other Fabric built upon a good Foundation. Pillaring of Beams is to a Ship as Bracing to a Drum, to keep all the Decks in true Order and Method both for Wear and Use.

Another Caution ought to be in placing the Beams clear of the Masts Places and Hatch-ways; in order thereto the main Hatch, which is principal, ought to be as near the Middle of the Ship as possible; and also the Place of the Main-mast *c* will be near the Hatch-way; the other Hatch-ways are always made according to the Use the Ship is design'd for. But the Masts Places and main Hatch-way are general, and founded on a Custom, that from the Length of the Ship the Distance is set off from the Stem for each Mast's Place; and this is for a Three Mast Ship. All other Ships or Vessels have the Centers of the Masts assigned; but all proceeds from Custom, or Fancy of the Manager, as also Hatch-ways, that the Lading and Unlading of the Ship may be with as much Facility as possible, both to the Ease of Men and Wear of the Ship.

g. are Riders placed to scarf the Floor and lower Foot-hooks, and called Floor-riders. They are of great Use in Grounding, especially when they have cross Pillars set upon them. There are also lower Foot-hook Riders to scarph the Floor-timbers, and second Foot-hooks. For 'tis certain, if a Ship could be built with one Piece, she would be much stronger than to have a great many Pieces, since at the Head and Feet of each Tire of Timbers Half is cut off.

i. is Breast-hooks placed in the Breast, or foremost Part of the Ship, to hook or tie the two half Parts of the Ship together.

K. is a Piece of compass Timber proposed to scarf the Keel and Stern-post together, in the lieu of tenanting the Post into the Keel.

A.

A. are lower Wales, which ought to be placed after such a manner, as to bind, strengthen, and be bolted through most of the Gun-deck Knees. For since the Breadth of any Ship is consider'd as the Place of the greatest Strain, being that Part which makes a Division of the Wind and Water; as the Impulse of Wind forces against the Sails, so the Water on the other Hand supports the Ship, and keeps her as much as possible in her natural Position.

The Wales shape the Ship, making her look regularly curving and lively, and ought to be scarfed clear of the Scarfs of the Clamps within board.

b. are Channel-wales lying in the Midships, to make the lower Ports upper Part. The Channels for the Shrouds are placed upon the uppermost of the Channel-wales, and the Chain-bolts are drove through the lower one.

P. is the Poop, and *Q.* the Forecastle. *O.* the Quarter-deck. *M.* the Upper Gundeck. *N.* the Middle and the Lower Gundeck. There is another Plan under that, which is the Orlope or Platform.

C. are Bit-pins, on which the Cables are fastned. *R.* the Bowsprit, or a Security for the other Masts.

Fig. G. is a Plan of the Orlope, on which are placed the Store-rooms, Cables, and several Officers Cabins; which Plan divides the Hold into two Parts, for the Conveniency of keeping dry Goods from Wet. *A.* is the main Hatch-way, *b.* the Center of the Main-mast, *c.* the after Hatch-way, *d.* the Flag Officers Store-room, *e.* the Captain's Store-room, *f.* the Surgeon's Cabin, *g.* the Center of the Mizen-mast, *h.* the Steward's Room Scuttle, *i.* the Fish-room Hatch, *k.* the Steward's Room, *l.* the Purser's Cabin, *m* a Slop-room, *n.* the Surgeon's Mate's Cabin, *o.* the Bread-room, *p.* the Sail-room, *q.* the Boatswain's Store-room, *s.* the Gunner's Store-room, *r.* & *s.* Apartments for Powder, to fill into Cartridges, and to secure it when fill'd, *u.* a Powder Trough to empty the Powder out of the Barrels, in order to fill the Cartridges. It will be very requisite to have the Filling-room as low as the Ship will possibly bear it, and to have it half in the lower Powder-room, and half in the Store-room, as may be seen in Fig. B. *s.* is that Apartment. *z*, *y*, & 6. are Lanthorns fixed after such a manner, that the Candles may be placed in any of them, without coming into the Store-rooms, which is extreamly

 conve-

convenient, especially in Powder-rooms, as has been woefully experienced. w. is the Carpenter's Store-room, r. the Fore Hatch-way. 2's are Cabins fitted by the Side, for Lodgings for the Quartermasters and their Mates, &c. Tho' in time of Engagement the Sides in the Wake of those Cabins are kept clear, for the Conveniency of the Carpenter's finding where the Shot is drove in under Water, that they may come to stop the Leaks.

There are several other Conveniencies for Stowage in this Plan; as Hawsers for the Shrouds, Cablets, Pitch, Tar, Anchor-stocks, Planks, small Masts and Yards, Spars, Platform for the Surgeon's Use in dressing wounded Men, and several other Uses which being so various, cannot be well inserted in the general, but are universally beneficial for stowing up Lumber, that could not so well be laid up in other Places.

Fig. D. is a Plan of the Lower Gun-deck, consisting of Beams, Carlings, Ledges, Knees, Partners, Capstands, Cross-pieces, and Bits, &c. The Red in this Plan is Beams; the Yellow, Knees, as Arms to hold the Knees and Sides together; the Green, Carlings; the Blue, Ledges; and the Bounding of the Plan represents the Ship's Sides; the Out-board Plank Yellow, the Timber Black, and the inside Plank Green. It has been observable in laying Floors in Houses, or great Fabrics, that 'tis good Management to divide the Floors into Girders and Gise; that in case a Floor was proposed to be laid of 4 Inches thick, being divided into Gise of double Thickness, and to lie at quadruple Distance, the Strength would be equal, and but half the Stuff used; and one Girder of 16 Inches square would be almost equal in Strength to 17 Gise of 8 Inches broad and 4 Inches thick; which Girder contains but half the Stuff of the 17 Gise. But however this is in House Work, where the Case is quite different, from the extraordinary Strain, and other Circumstances, which ought to be throughly weighed in joining and uniting the Parts of a Ship. For here the Beams are considered as the principal Members that hold the Sides of the Ship together, against such a rapid Motion, which sometimes happens, by the extream Force of Wind, and Violence of the Sea. And the Beams are held with Knees, firmly bolted and clinch'd, and the Weight of Guns carried in such a Ship on the Lower Plan is near 80 Tuns, besides the Men and their Conveniencies. However 'tis one Ad-

vantage

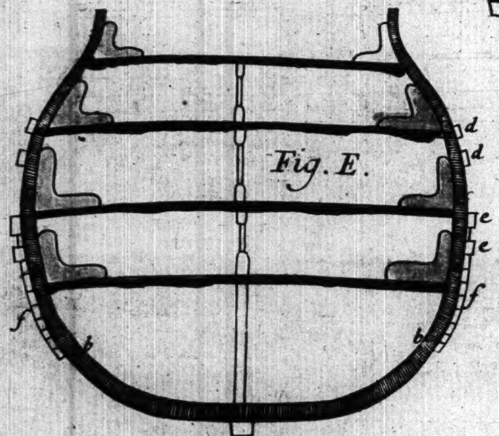


Fig. E.
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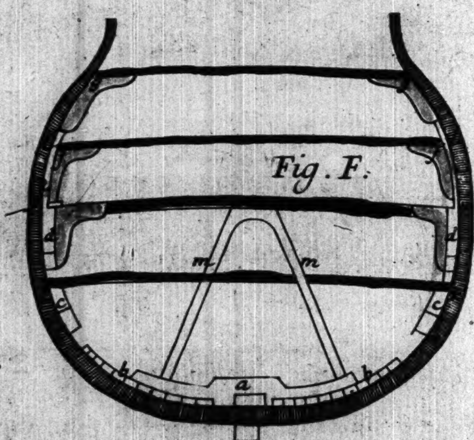
Fig. F.
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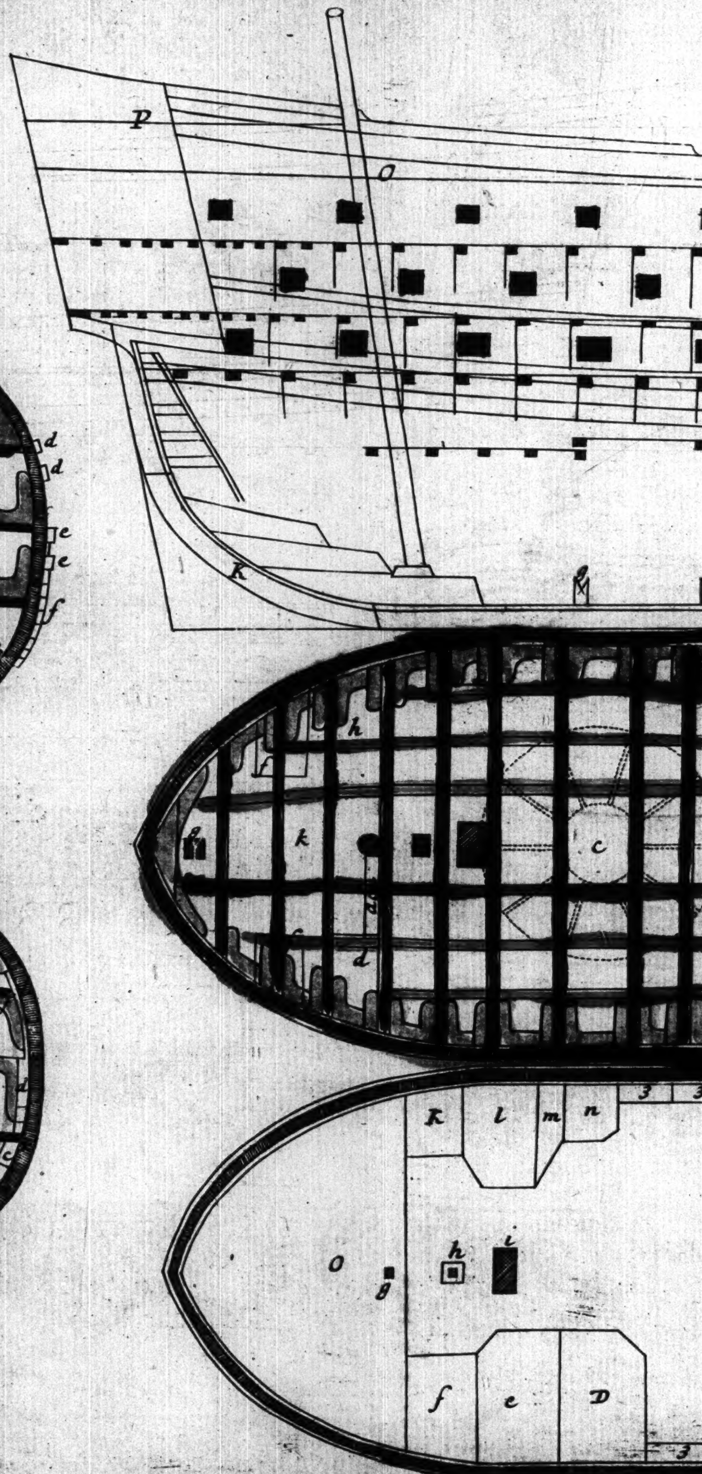
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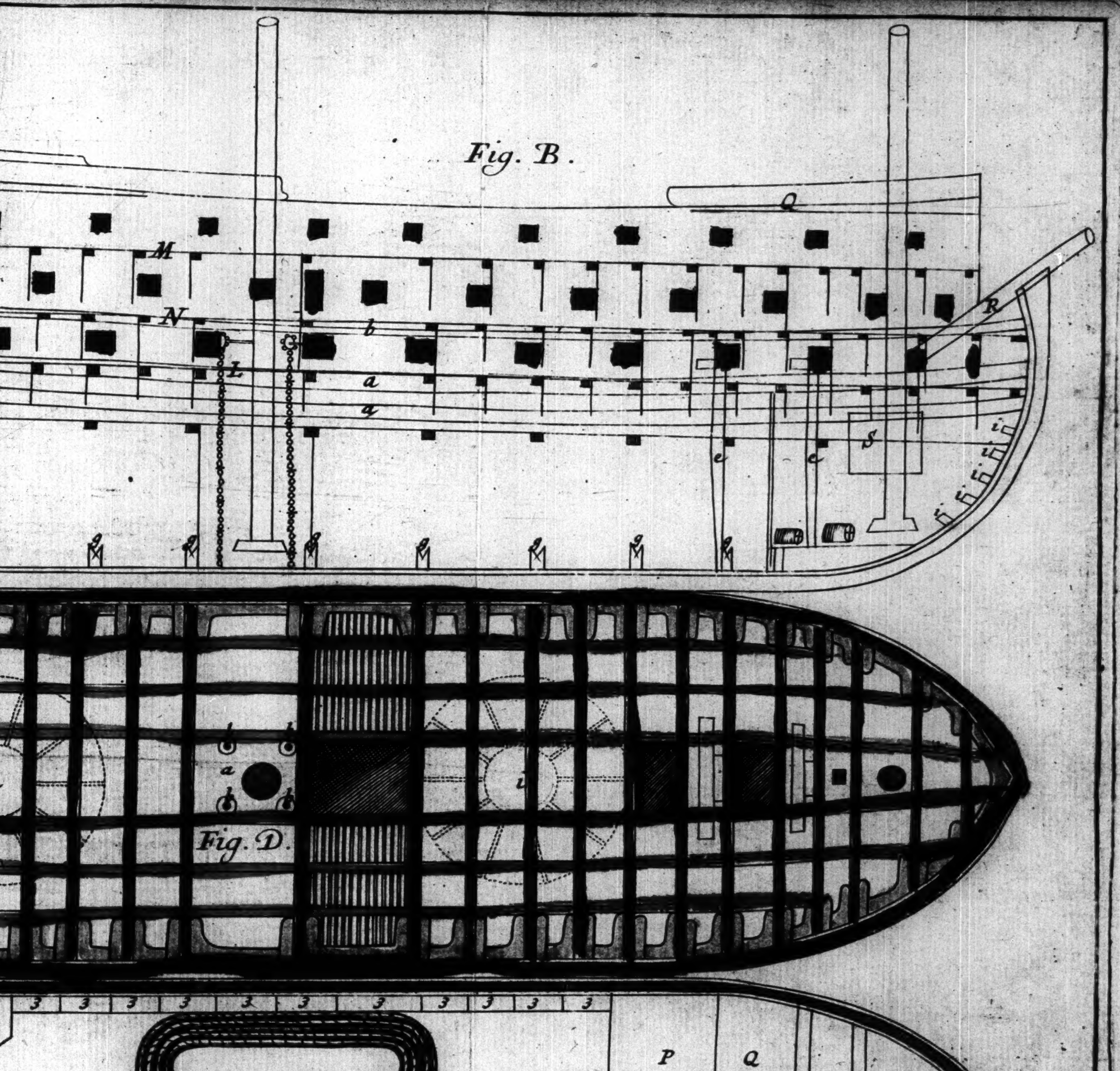
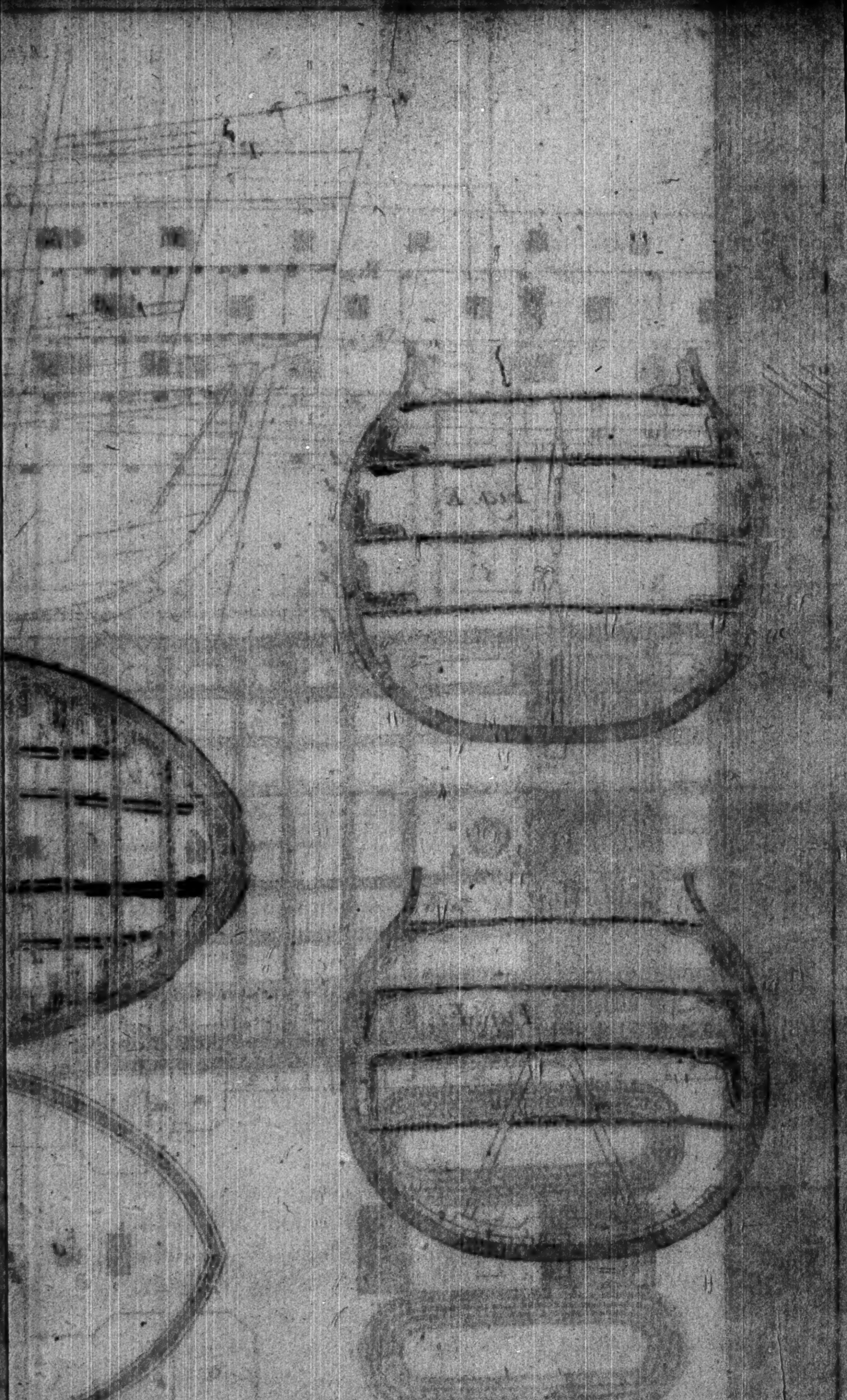


Fig. B.
Fig. D.
Fig. G.



vantage in Ships, that is not in House-building, that the Decks are well pillar'd, which is a great Stiffening.

There is likewise a great Quantity of Timber saved, by dividing the Deck into Beams, Carlings, and Ledges. For if instead of Carlings and Ledges in any Deck, there was to be a double 4 Inch Plank, then a whole Superficies of 4 Inch Plank would be more than 34 Beams of 18 Inches one way, and 16 Inches and ½ the other, with six Tire of Carlings and Ledges suitable for the Work. The biggest of our Shipping has but 4 Inch Plank for the Flat of the Lower Gun-deck, which is chiefly designed for Calking, to keep all dry. However this material Consideration ought to be in all such Cases, that the Plank be well supported, that the extream Distance may not cause Drumming, as the Shipwrights term it, which will not only cause Weakness where Strength is required, but also the Calking to drum, being nothing so durable nor so dry, as if suitable Strength was made to support and stiffen the Work.

A. is the Partners of the Main-mast, where the Pumps *b.* are placed; *i.* the Jear Capstan, *c.* the main Capstan, *K.* the Gun-room, *D.* the Gunner's Cabin, *n.* a Lady's Hole, or Place for the Gunner's small Stores, which Stores are looked after by one they call a Lady, who is put in by turns to keep the Gun-room clean. *g.* is the Bread-room Scuttle, *f.* the Gunner's Mate's Cabin, *h.* is often a Lieutenant's Cabin.

There are besides these a Plan of the Middle Deck, wherein the Furnaces for boiling the Provisions are placed, and Cabbins for Lieutenants, Master's Mates, and Midship-men. The Entring Ports are also placed here. The Upper Deck has also Cabbins for the Flag Officers, or Commanders, Lieutenants, Boatswains, Carpenters, and Mates; besides needful Contrivances for Rigging. On these two Plans you have also as many Gratings as can possibly with Conveniency be placed for causing Lights on the Plan below, as also to give vent to the Smoke of Powder in Time of Service. There is a Quarter-deck, Forecastle and Poop, with several Apartments for Officers, and Conveniencies for managing the sailing Part. Tho' all these Bulkheads mentioned being Eminencies, are a great Hindrance to the Motion of the Ship, especially when she sails against the Wind.

Fig. E. is the Bend of Timber in the Midship, and such Bends are placed at equal Distance, as may be observed in Fig. A.

Such

Such a Ship has 100 such Bends, only altering according to the tapering of the Ship. The Red is Beams, and the Yellow, Standers bolted through the Beams and Sides. Such Knees are apply'd to an old Ship to strengthen her. *a.* is the Floor-timbers, *b.* second Foot-hooks, *c.* the fourth Foot-hooks, *d.* Channel Wales, *e.* Main Wales, *f.* the diminishing Strakes to taper the Plank of the Bottom from 9 Inches to 4 Inches thick.

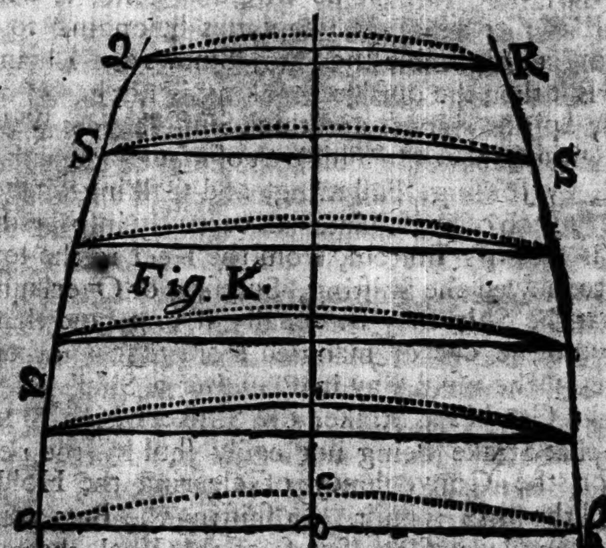
Fig. F. is a Bend of Timbers to shew another Part, where *m.* is Cross-pillars, the Yellow, Knees. The Cross-pillars are stepped on the Floor-riders, and fastned to the Gun-deck Beams, to support that extraordinary Strain, which is caused by the Ship's moving, and also in laying on the Ground. *i.* is the lower Foot-hooks, *k.* the third Foot-hooks, and *l.* the Top-timbers. In which you may observe the Timbers to be equally scarfed, the Middle of one Timber being in the Wake of the Head and Heels of the others. *a.* is a Floor-rider, *b.* the Sleepers or thick Strakes at the Floor-heads and second Foot-hook Heels, *c.* the middle Bands or Orlope Clamps, *e.* the Spirkit Risings, which are placed under the Lower Gun-deck Ports, *f.* the Middle Deck Clamps, *D.* the Lower Deck Clamps, *g.* the Upper Deck Clamps, and *h.* the Spirkit Risings under the Middle Deck Ports.

We observe this Method as near as possible, to lay our Ships Decks one from another either exactly parallel, or diminishing, according to the Uses requisite in such Decks. The Rules for doing the same have been always various, according to the Fancy of the Workman; some setting off the Decks, by stretching a Line on the Side, parallel and perpendicular from the other Decks. The Lower Gun-deck is set off from the Keel, tho' some Men work so very exact, that they will set off the Lower Deck from the Breadth Sir-marks.

But the usual Method is putting up the Beam Mould at the Heights in the Middle of the Ship, and setting off one Height on the Stem, and another at the Stern, and stretching a Ram-line from those Heights afore and abaft, till the Line by its own Gravity touch the upper Part of the Beam Mould, observing that the Beam Mould be kept to its true Rounding; then setting off several Spots on the Side, by keeping the Beam Mould at the Side, and the Line out of Winding with all the Spots you set off. After you have made your Spots pretty near one to another, mark out a Red Line for the more easy distinguishing; then level another

ther Line on the other Side of the Ship, from the first, exactly putting one out of winding, or parallel from the other.

But because a Line hanging by its own Gravity cannot be truly circular, but will be rounder in the Middle than at the Extreams; therefore after the Gun-deck is truly set off, either from the Sir-marks, or from the upper Edge of the Keel, it may be proper to set off the rest of the Decks from the lower Plan, by Perpendiculars and Parallel Heights. The same may be said of the Wales. The properest Method is to set off Perpendicular Heights from the upper Edge of the Keel.



But the general Mistake in setting off Ships Decks, is, the not observing to shorten the Beams aft and afore, by which means the Decks in the Midships round a great deal more than at the Extreams, causing the Decks at the Side and in the Middle to be different, by hanging transverse-ways, or fore and aft, as in the Figure K. Let *a. b.* be the Breadth of the Ship in the Midship, and *c. d.* the Rounding of the Beam there; so that *b. a. c.* is the crooked Line that all the Beams are moulded by. And supposing the Ship tapers aft or forward, according to the Lines *a. s. b. s.* then if the Beams are required to round equal and alike, *Q. R.* should round as much as *a. b.* and every Beam must have a diffe-

rent

rent Radius, as may be seen by the pricked Lines, that every Beam may round according to those pricked Lines, to make the side Lines and middle Lines of the Decks out of winding one with another.

PLANKING.

PLanking must not here be omitted, which is a Branch so very material, that unless it be carefully done, it will undeniably mar all the other good Properties belonging to any Ship. For Planking a Ship is like the Skin, Sinews and Ligaments to an Animal. But then the outside Planking is not barely meant, but all Clamps, Spirkit-risings, and thick Stuff, besides Wales, Channel-wales without board. This part of *Planking* ought to be well performed, by Joining, Fastening, and Calking, and the Goodness of every Inch of those Materials carefully inspected.

Fig. B. is a Ship's Bottom, from the Keel to the lower Wale, wherein are shewed the Shifting, Scarfing or Overlaunching the Planks, that the Ship may be equally strong, and that one Part of her may not be cut or mangled more than another; and in order thereto, the usual way in Planking a Ship's Bottom, is to leave out the Gar-board Strake, the Strake which is next to the Keel, but that Strake being not easily shut in, the next to it is left out, for the Conveniency of clearing the Hold of Chips or Dirt, till the Ship is built. In shifting the Buts you must not fail to put them clear of the Scarfs of the Keel, that a Buts-end may not be put in the Wake of the Pumps, which may be of dangerous consequence either in starting the But, or sucking the Ockham out of the Seam.

In the next place, observe the Lengths and Breadths of the Plank you have to use, cut the Rabbit of the Keel, Stem and Stern-post the exact Bigness of your Plank. The Length of the Plank you have to work is principally to be observed; for if you cannot continue working up to the Wale, nay and the lower Wale too, with the same equal Lengths that you begin with, you will certainly be at a loss, and have worse Work upwards in sight than you have lower down.

The

The Breadths ought to be considered, and also the Fashion of the Plank. For if you design to bring every Strake of Plank to the Stern, you must observe the Shape of the Ship's Body; since it will be very difficult to do it in some Ships that have large Floors and full Bows. It's therefore very customary in many Ships to drop or steal, as they term it, some Strakes short of the Stern, and raise what you can regularly in the Bulge and Loof. You will likewise be obliged to have snying (or crooked) Planks to continue the Custom that's now practised. However, let the Custom be as it will, as much as possible keep your Work from extream Snying or Cambering.

The After Part of the Ship ought also to be minded, where the Ship's Body is a hanging Conoid, and the Tangent Line perfectly streight, by which means most Ships have Hollows so long and deep, that you cannot well work the After End of the After Planks too broad, to bring the Plank's Edges streight, that they may lie on a direct Plan, out of Winding.

The best and most proper Way is (if a Workman could be allowed such a Privilege) to see the Fashion of the Ship's Body, and the different Length on the Girt at every Frame-Bend, or third or fourth Timber, from the Keel to the Wale. Then he might make exactly equal Divisions, and every Plank might be of equal Breadth throughout the whole Work. An expert Workman however thinks it no difficult Matter to birth up a Ship's Bottom exact and genuine. For afterwards it's but to observe the true Swing of the Ship's Body, and make the Edges of all the Planks streight, and Afore, that the Edges be rounding, by regular Curves, according to the Nature of the Ships Bodies. Otherwise the Ribbons are as good a Guide as need be, being perfectly streight Aftward, and will lie no otherwise than on a direct Plan, and Afore they are rounding according to the Nature of the Ship's Body or Bow. But however, to set off the Height of the Wale in divers Places is very proper; for the exact Gaging of the Strakes of Plank, especially upwards, where it's very commendable to see Work well and exactly performed.

'Tis also allowed in Shipwrightry, that if three whole Planks be wrought between two Buts, from 4 Inch Plank to the thickest Stuff, if one overlaunch the next but 6 Foot, it's sufficiently strong. And according to this Rule 'tis generally order'd to fall out in the thinest Plank: Tho' a nice Proportion of such over-

launching

launching and scarphing of Plank will come nearest to the Cube Root of the Length that each Ship is one to another. And if it is demonstrable that by such a Method 'twill be sufficiently strong, then it would be most proper to provide and plank Ships Bottoms according to the Magnitude and Length of each respective Ship that is immediately to be planked. Since the Price of Plank and Timber increases or decreases according to the Bulk or Usefulness of each Piece.

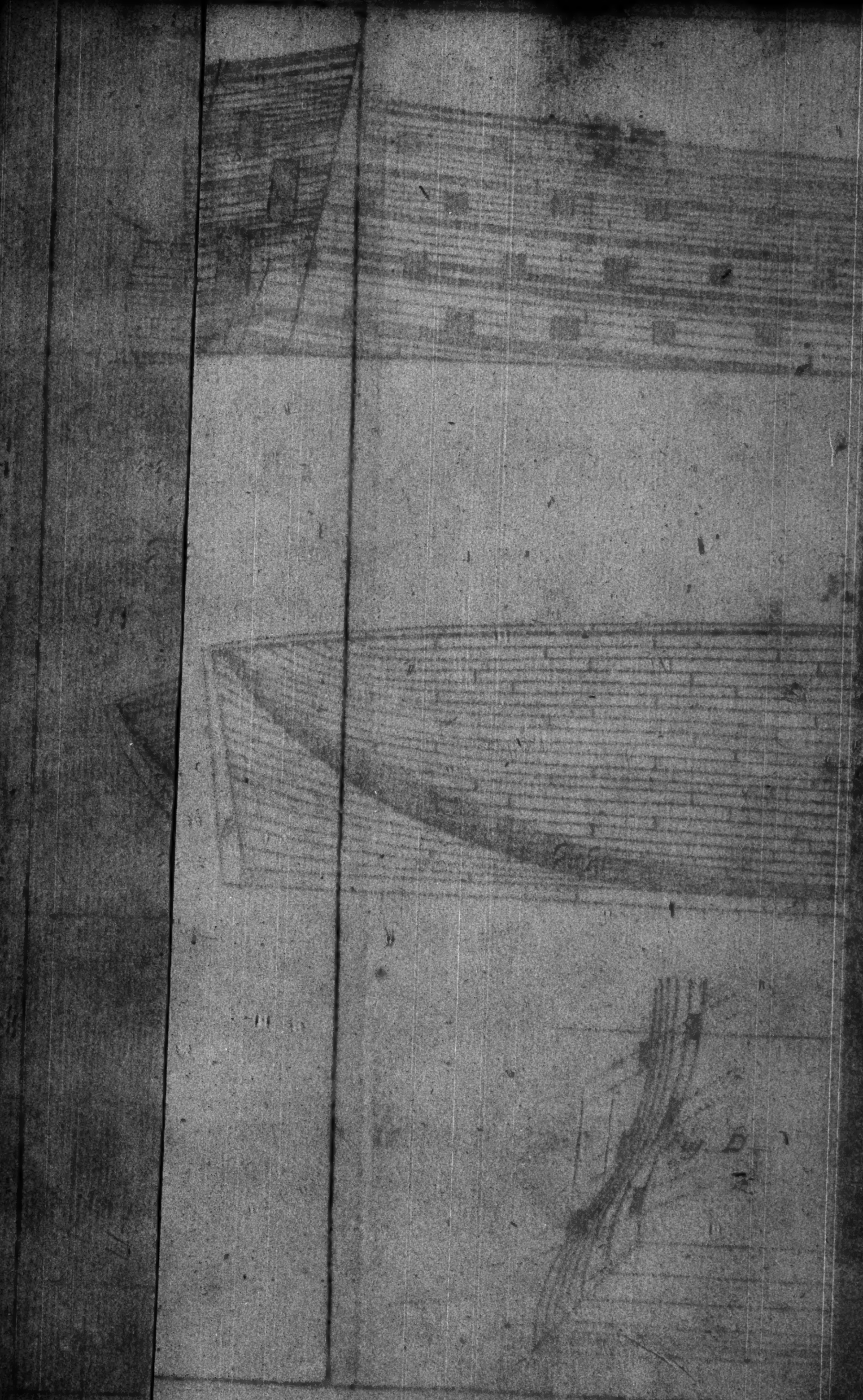
But if there be a false Notion in converting Plank, or if it be meant rough Plank as well as rough Timber, 'tis very prejudicial and destructive to the Manager. For in Plank we consider here but of two Dimensions, Length and Breadth, since the Thickness gives it the Name of Plank, according to the Size it bears. So that Plank and thick Stuff for Ship-work may be exactly fitted to their Length and Breadth, tho' 100 Miles from the Ship they are wrought upon; since the $\frac{7}{8}$ of all sort of Plank for Ship-work is a perfect Parallelopipedon, streight, and of Parallel Breadth: And whoever considers it otherwise, wastes $\frac{1}{7}$ of such a valuable Commodity as Plank is by false Conversion. Indeed Afore and Abaft the Plank is of another Fashion, and is termed snying afore, and a short Turn of snying Abaft; but however such Plank may be as exactly provided, as has been proved elsewhere.

The cross Marks are the Buts Ends, which are shared with as much Indifferency as possible, that every Part of the Ship may be of equal Strength or Weakness, which is caused by those Buts Ends; since equally to share Buts, and work 3 whole Plank between 2 Buts, is to work all 24 Foot Lengths, and with 30 Foot Lengths 4 may be wrought between, and so on. Notwithstanding a Ship will be the stronger for having long and broad Planks, provided they are well fastned and join'd, and continued throughout the whole Ship; if not, the Property will undeniably be otherwise.

At the Breadth of the Ship under the lower Wale you work 3 or 4 Strakes, diminishing in large Shipping, to bring 8 or 9 Inch Stuff to 4 Inch Plank.

The Plank of the Buttock, or Aft Part of the Ship, is very difficult to work, by reason of a sudden Round, about the Fashion-piece. The Plank therefore provided for that Purpose ought to be the best and choicest, free from Knots, or any other Defects. The Outside of the Tree, and the Ground-end, is al-

ways



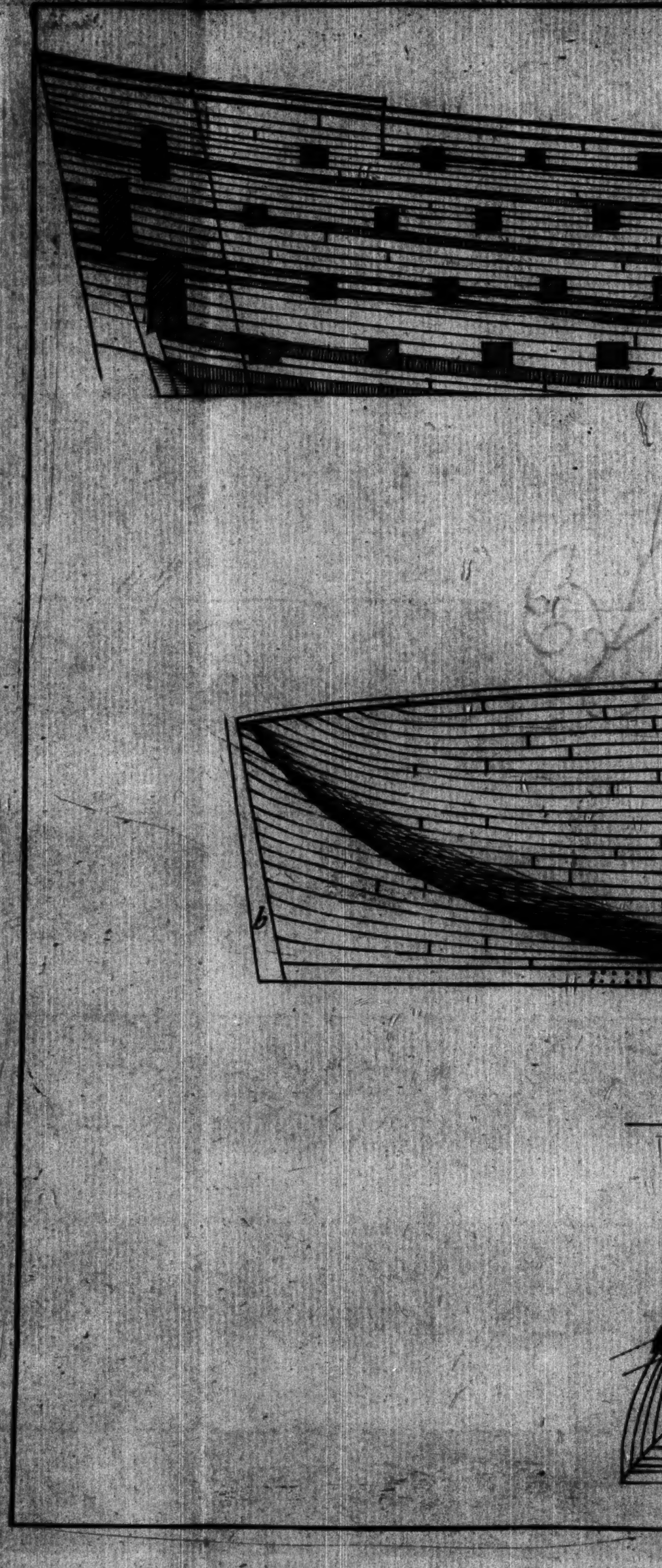

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Fig. A.

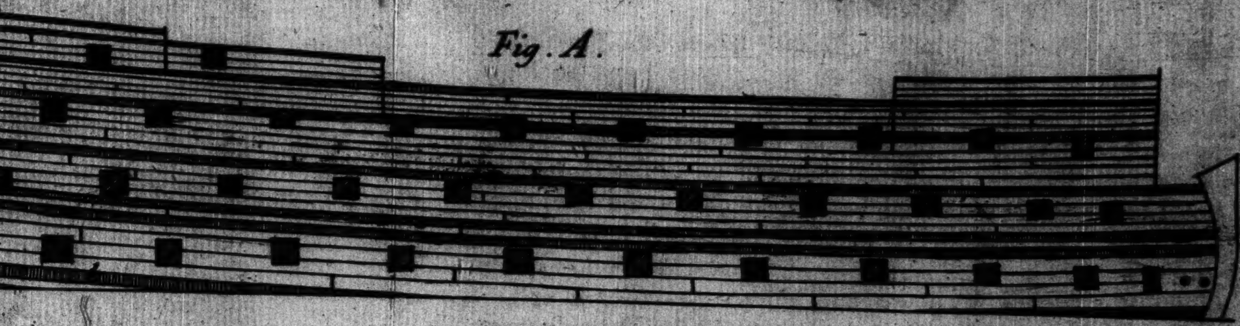
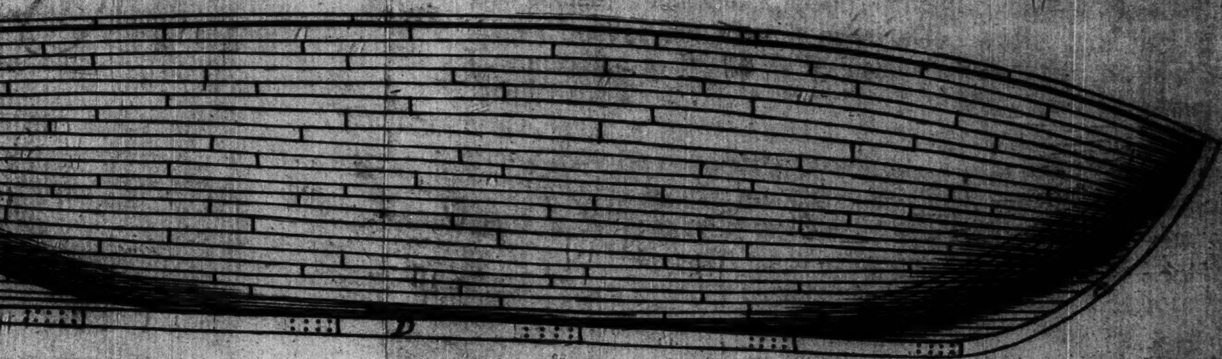


Fig B.



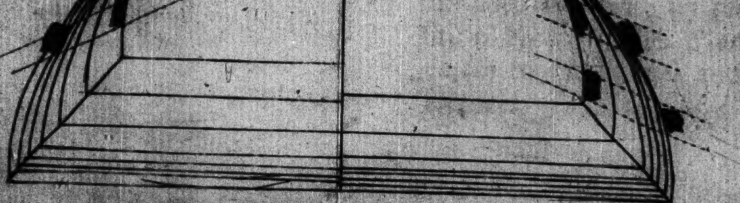


Fig. D. *Fig. E.*

ways best for that Purpose; and so for all other Plank that is much bent by Fire. *D.* is the Keel, *c.* the Stern, *b.* the Post, *c.* the Transoms, and *a.* the lower Wale.

Fig. A. is a Ship planked up from the lower Wale to the Top-timber Head. And the principal Regard in this Particular is to shift as clear of the Port-holes as possible, that what Weakness is caused by cutting such Holes, may be strengthned by the Work that is brought on near them. The inboard Work is always allow'd to contribute most towards the strengthening, since it's generally thicker Stuff, and well hooked and scarfed. And a due Consideration ought to be taken in Planking within-board (since 'tis the last Side planked) to shift the Buts clear of them without-board; to flat-scarf the Foot-waling, that the Timber may have but two Holes instead of four, which would be required in working common Buts.

a. is the lower Wale, *b.* the upper main Wale, *c.* the Channel-wale, and *d.* a Wale on the upper Part of the Middle Deck Ports. You are also to observe, that all projecting Parts of such Wales are laid parallel to the Horizon; altho' that Part which makes the Seam for the Ockham, is in all Work perpendicular to the Timber in the Wake; otherwise the Calking would force the Plank's Edge off, and not be good Work, as shall be hereafter more fully illustrated.

Fig. C. is the Shaping of any Ship upwards, termed Sheering of her, the better to accommodate it to the Element she is to act in, when so disturbed by the Violence of the Wind, that its turgid Billows equal Mountains. 'Tis then very suitable to the Nature of such a Machine to be curved, since the Body of any Ship under Water is no other than a hanging Conoid, and is not supported by her natural Body near so well Afore and Abaft, as she is in the Midships, or largest Part of her. From whence the Weight of the Extreams will cause an Alteration in the Sheer, as soon as ever the Ship is launched, and in the Water. So that if a Ship was made perfectly streight, and parallel to the Surface, she would look broken backed, or to speak more properly, Camber-keel'd.

The Opinion of Men in this Point has been various, both as to the Proportion of hanging in 20 Foot Length, and the Difference in the Height between the foremost End, and that Abaft; there

 being

being an opposite Conveniency in the two Properties, tho' in their Nature they answer the same Effect.

It is the Opinion of several, that the quicker the Sheer is, the more it contributes to the Strength of the Ship, and makes more Heights upwards, which accommodates the Ship, as does likewise the laying of the Wale higher Abaft than Afore; since the accommodating the principal Officers Cabins is what is aim'd at, which are always placed Aft. This Property of quick and different laying the Wales will be most suitable to Great Ships, which carry a great many Officers, and ought also to be built very strong. But in small light Ships, that are only built for Runners, and where perhaps there are but few Officers that expect great Apartments, the streighter and snuger the Sheer lies, the less Wind is held to hinder the Motion of the Ship. For undoubtedly every Bulkhead, and the Cavities which are opposed to the Wind, hinder the Ship.

Therefore this Figure cannot at one View be made general, because of the Variety in the Crookeding of Ships. However, it will lead towards a Rule to make all Shipping similar in their Curving, or Crookeding the Sheer, since 'tis an usual Method, from a Boat of Ten Foot long to a Ship of 170, to give the Hanging either in the whole Length, or in 20, 10, 5, or any Number of Feet in Length; only observing that the whole Length of the Ship must be taken, from the Chord Lines *a. b. c.* and the hanging or rounding of the Sheer in her Length, from the perpendicular Lines *d. b. e.* and measured on different Scales. The Scale *A.* measures the Length of the Ship, and the Scale *B.* the Hanging. But to find the whole Hanging, from the Hanging in 20 Foot, square 20, and square the Length of the Ship on the hanging Line; then say: If the Square of 20 gives 1 Inch and ½, or any other Hanging, what will the Hanging or Crookeding of the whole Length of the Ship be?

A. B. C. are 169 Feet, the Length of the Ship on the Sheering Line, and *B. E.* the Hanging in the whole Length, *f. g.* 20 Feet, and hangs 1 Inch and half: *a. b. o,* 10 Feet, the Length of the shortest Boat that's fit for any Service, and *b b,* 4 Inches of the whole Hanging.

Not that this true circular Sweep can so correspond, as to make an exact Sheering Line, since a Ship's Body consists of

Elip-

Eliptic, or spiral Lines, terminating at each End in a Point. Whatever then the Lines are, that taper the narrowing of the main Breadth (which is near the Place where your Wale lies against) the Sheering Line should answer both to the Length and Crookeding of the same.

Fig. D. and E. shew the Shape of the Body from the main Breadth upwards, D. being the aftermost, and E. the foremost Timbers, the Red shews the Shape of the Wales, and how those Strakes that project should be managed.

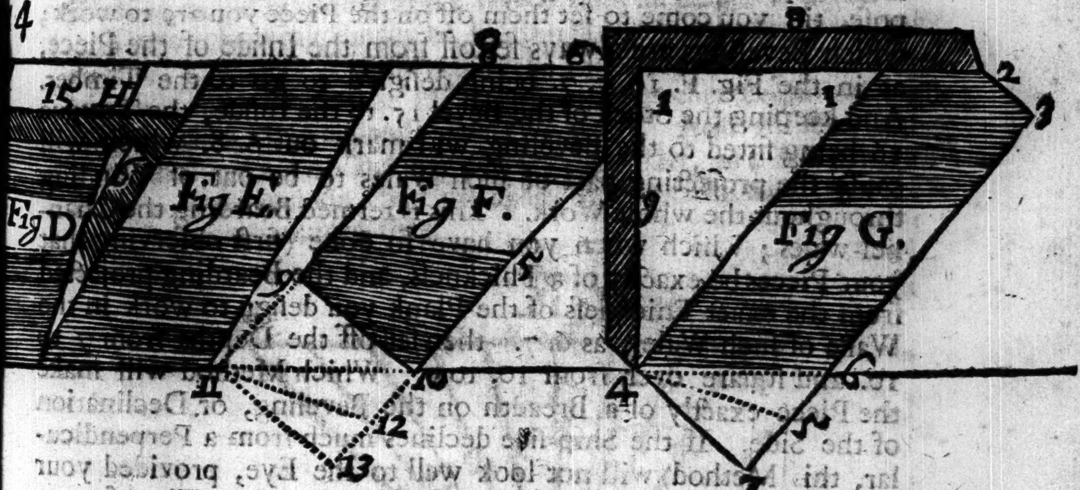


Fig. A. shews the Winding, Twisting, or Wreathing of a Ship's Timbers above Water, which is caused by accommodating

 the

the After part of the Ship. And forward it's to make Provision to keep the Anchor from the Bow, when purchaced by the Cat-Tackle.

B. is the Shape of the Channel-wale at one Beveling or Aft part of the Ship, where the Timbers are near upright or level; C. the Shape at the next Beveling; D. the next; E. the next; F. the next. And after a Piece of Timber is cut to its Thickness and Depth, there is always left some Wood to work on, more or less, according to the Ability of the Sawyer, since very few Sawyers can work so true, or make their Conversions so exact, as most Shipwrights can with an Addice. The Piece is cut in the Fashion of a Parallelopipedon, and trimmed after that manner, and the Lengths of the Pieces set off on the Ship's Side. In the Length, 3, 4, or 5 Sirmarks are made, according to the Length of the Piece, and at every Sirmark the Beveling (or Declination from a Perpendicular) is taken with a Level and Bevel, as the Figure H. having one Limb perpendicular to the other, as 14 and 15. The other Limb 6. being so to move, that by keeping 16. on the Side of the Timber, and 15. parallel to the Horizon, and the Plummet in 14. perpendicular to 15. then 6 gives the Declination of the Plain. When the Bevelings are taken, you mark them off on a Wedge, or Piece of Batting for such a Purpose, till you come to set them off on the Piece you are to work; which Bevelings are always set off from the Inside of the Piece, as in the Fig. F. 10. 5. 7. being design'd to go to the Timber. And keeping the Stock of the Bevel 15. to the Inside, the Tongue 16 being fitted to the Beveling will mark out 6. 8. which will cause the projecting part of such Wales to be out of Winding throughout the whole Work. This is termed Bearding the Channel-wales; which when you have so done (first observing that your Pieces be exactly of a Thickness, and the Bearding projected from the exact Thickness of the Plank you design to work in the Wake of such Wales, as 6. 7.) then set off the Depths from 7 to 10. and square over from 10. to 9. Which Method will make the Piece exactly of a Breadth on the Beveling, or Declination of the Side. If the Ship-side declines much from a Perpendicular, this Method will not look well to the Eye, provided your Sight is level from the Object, or Channel-wale. Therefore to make such Wales of equal perpendicular Heights, you must proceed as in the Figure G. by making use of such a Square as the Red,
pla-

placing one Limb on the Bearding 1. 2. and setting off the exact Depth you design the Piece to be. On the other Leg, the Point 4. will mark out the Breadth, or more properly the Depth of the Pieces fore and aft the Ship. Then you may either make the lower Part of the Wale parallel to 1. 2. which will be the Level as 6. 4. or parallel to 2. 3. which will be square. But the lower Part is commonly set off between a Level and a Square, in such a Method, as the Line 4. 5. But such a Method will require more Waste, or Wood to work on, if the Declination of the Ship's Side be much.

There is yet one Observation worthy of Note in working the Channel-wales, which are crooked, call'd Harpings, and Following Pieces to the Harpings, since such Pieces ought to hang neither more or less in their Length, on a direct Line fore and aft the Ship, than the Midship Pieces. But such a Crookeding cannot be so well mark'd on them, by springing a Line by its Elasticity; for so large a Spring cannot possibly fall exactly true. It will therefore be more proper to put such a Piece into a Position, that it may, after it is pointed with a Plummet, be alter'd from that Position, into such a one, that, when the Sides of the Piece are made perpendicular, will either hang or be crooked as you please, according to what you design: Which is done only by canting the Piece, as 'tis call'd, backward and forward, according to the Hanging and Crookeding you design to give.

These following Pieces or Harpings commonly wind or twist two Ways, as may be observed by the Lines 1. 2. 3. 4. 5. 6. 7. 4. being perpendicular to the Horizon, and the other declining from the Horizon, or perpendicular two ways. And in such cases you must have two Bevels, putting one Part, as the Stock, parallel to the Horizon, and the other Stock of the other Bevel always perpendicular to that.

FigB

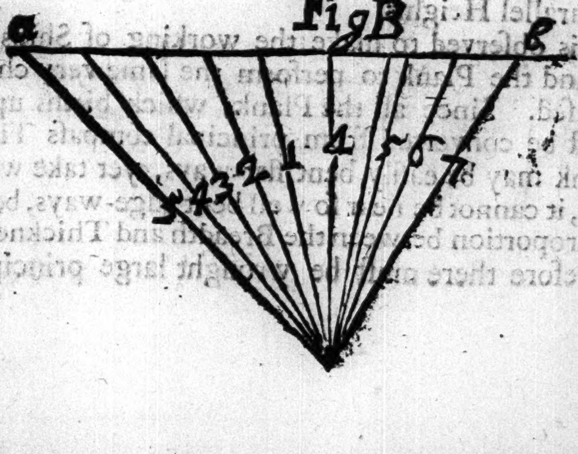


Fig. B. shews the Nature of such Bevelings in the Wake of any following Piece, 4. being perpendicular, and where the first Bevel Spot ought to be taken, 1. 2. 3. being Bevel Spots afore the Middle of the Piece, and 5. 6. 7. abaft that 4. Spot. Therefore to put this Piece out of Winding, is to make the upper Edge according to the Line *a. b.* which is to keep the Limb of your level Bevel *H.* in the Figure D. always exactly in the Line *a. b.*

There is still another nice Point to be considered in the Harping, which is always round as well as the following Pieces; and altho' Wales, yet they may be bent by Fire, provided there are not Pieces at hand, which are as circular as are requisite. But the Observation is in taking the Bevelling; for if the Ship is placed much by the Stern, there must be an Allowance for that Declination of the Ship, in taking of the Bevelling of the foremost part of the Harping.

All Plank ought as much as possible to lie on a direct Plane; for in any other Position 'twould be more dangerous (in bending or twisting of them to their Work) than if they rounded on a direct regular Plane, considerably more in proportion to such an irregular Twist.

In working up a round Buttock of a Ship, the lower Edge of the Planks will have a sudden Sny Aft, tho' the upper Edges are always lined streight. So are also the Planks under the Nuckle Timbers forward, and perhaps the After Ends of such Planks as the Buttock; and the foremost Ends of the others (according to the Fashion of the Ship) are 16 or 18 Inches broad, and the other Ends not above twelve.

All Planks under the Wale ought to lie upon direct Planes, as soon as they can be brought to such a Position, and above the Wales you are to work the Breadths of all Plank by Perpendiculars and parallel Heights.

Snying is observed to make the working of Ships Bows very difficult, and the Plank to perform the same very chargeable to be purchased. Since all the Plank, which births up any Ship's Bow, must be converted from principal compass Timber. For altho' Plank may be easily bent flat-ways, yet take what Method you please, it cannot be near so well bent edge-ways, because of the great Disproportion between the Breadth and Thickness. In such Bows therefore there must be wrought large principal Timber, if

Fig. A

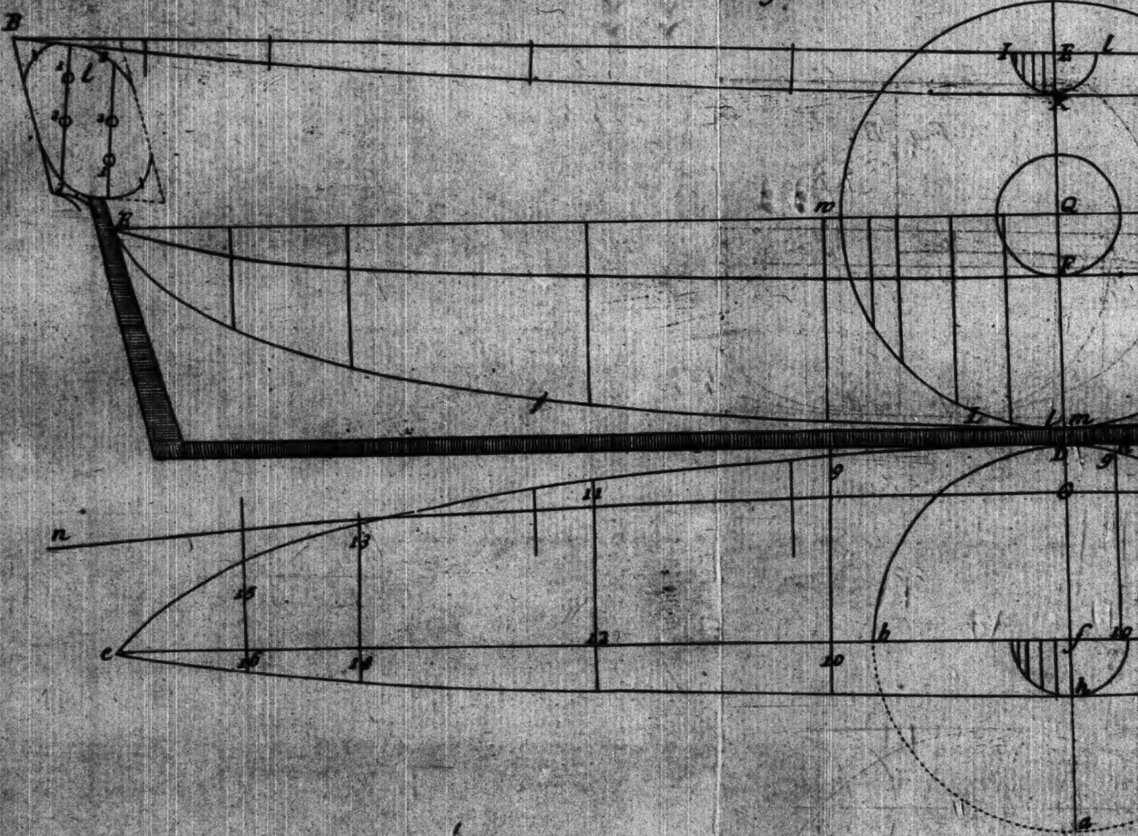
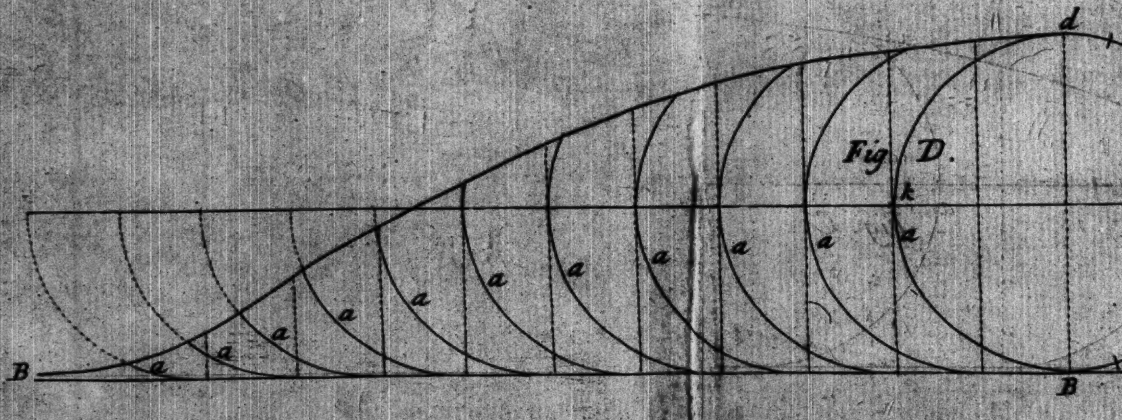


Fig D.



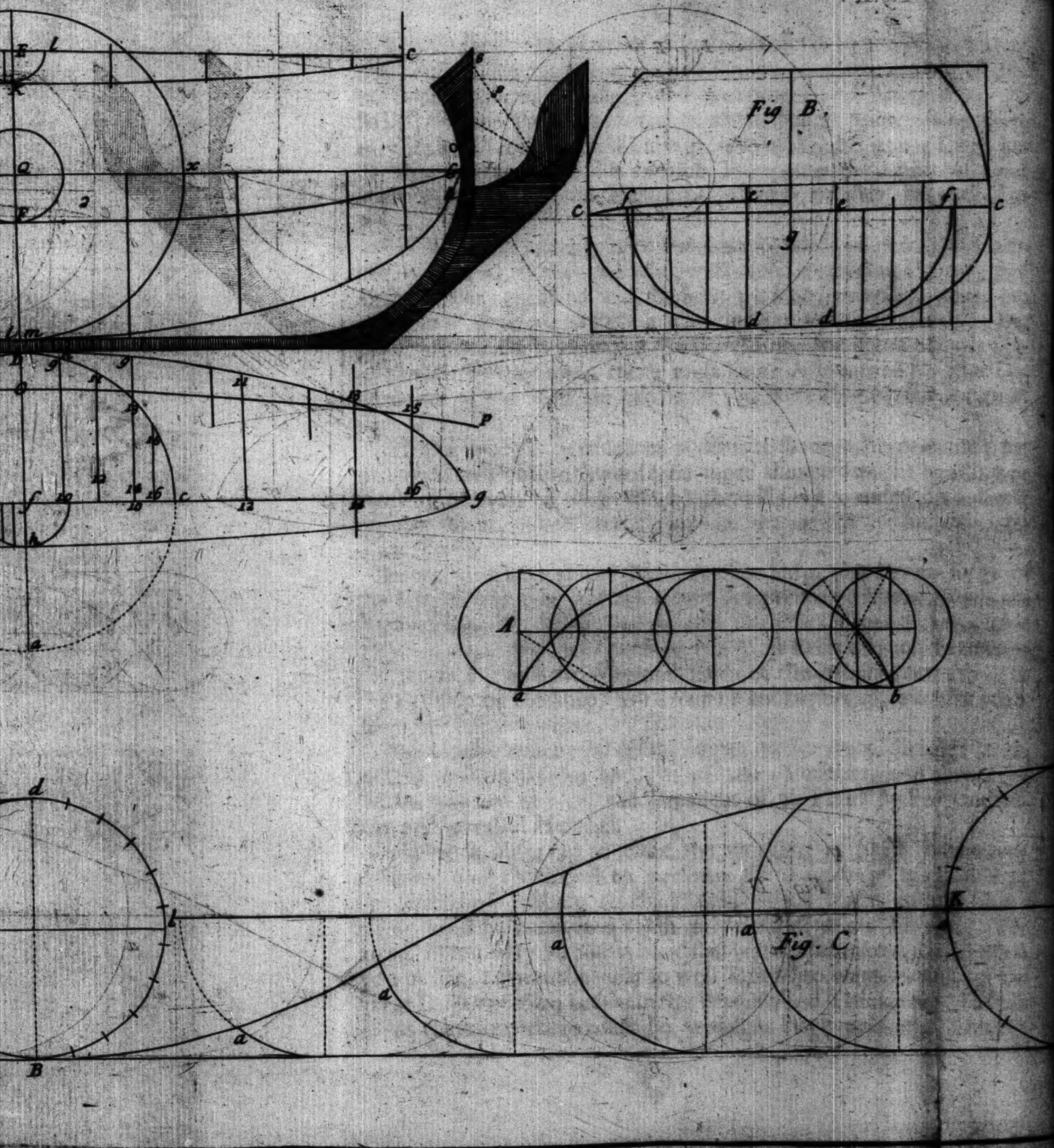


Fig B.
Fig. C

if you perform the common Method of bringing every foremost Hooding's End to the Rabbet of the Stern.

Snying may be consider'd from the Nature of a Cone: For let the Cone be cut as often as you please parallel from the Base, it will always be straight edg'd, and so will any Plank that is wrought upon a Ship's Bow, provided the Timber out of which it is cut be big enough to allow the Beveling, or Declination, that is caused by the Sloping of the Surface of a Cone compared to a Ship's Body.

Fig. A. and C. is to shew the Quadrants, which being cut close to the Perpendicular Lines, and roll'd up, will make a very comely Cone, and the Base will be equal to the Circle in Figure B.

Now as long as the Cone is roll'd up, and in proper Shape, let it be cut as often as it can, every Surface will be streight, provided it be cut perpendicular to its Spindle or Axis. But if 'tis unroll'd and laid open, every equal Perpendicular Height will be curved, according to the circular Lines in the Quadrants C. which will be found to increase its Crookeding, the nearer it comes to the Center E. So that the greater the Round is, and the shorter the perpendicular Height, the more the Snying is increased in any Ship's Bow, and the Plank or Board that works it.

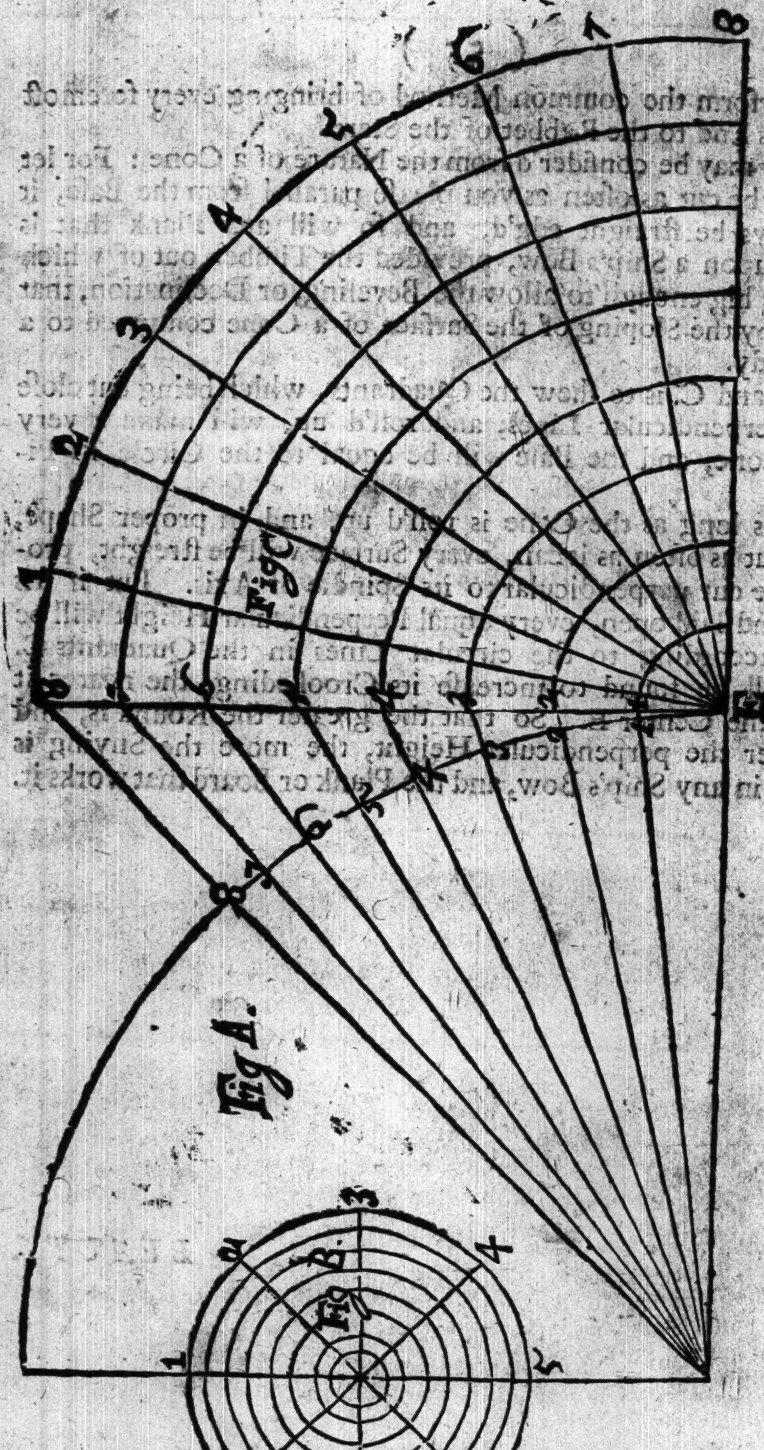


Fig C
Fig A.
Fig B

Of BEAUTY.

THIS Branch teaches to deck or adorn a Ship, or such like Machine, with that Symmetry of the Parts, as to render it agreeable to every Spectator; but with this Proviso, that the Beautifying may be no Detriment to the other good Properties.

And here a very delightful Scheme presents it self, if we consider the admirable Contrivance of Nature in the Production of Natural Bodies, formed after the most exact and accurate manner. From whence, as I hinted in the Beginning of this Treatise, Observations may be made for laying down Rules useful both in this and other Arts. But it may not be amiss further to take notice here, that there is a vast Difference between Bodies wholly immersed, as Fish, and those which carry their Bodies in two Elements, as some Fowls. Wherefore before the true and exact Shape of a Ship be fix'd on, the Proportion ought to be truly consider'd; which cannot be better determin'd than from observing out of the vast Number of Ships that are in the World, which are the easiest and pleasantest in the Wear, and have likewise all other good Properties. These are the Ships which should produce the Lengths, Breadths and Depths of all Shipping. But as to the Shape, it ought to be taken from Art and Nature, and drawn from a Globe. Not that any Ship can be thought regular, or rather convenient, perfectly globular; for then she would not answer the Design of such a Machine, but move always that way which the Wind forced her, or directly from the Wind's Eye. For it is very observable, that altho' the Wind has a great Power over any Ship, as long as she is at rest, and before any Sail is set or spread upon her; yet when her Sail is managed and trim'd to it, she will, by traversing, sail directly in the Wind's Eye, which would not be, was she as broad as long; for then she would move with the same Facility side-ways, as endways, and go directly with the Impulse of Wind. However, a Ship may, and indeed ought to be formed as near a globular Figure as can possibly be allowed, with respect to the other Conveniencies that will be requisite in managing of her.

Fig. A. may ſhew, that *a. b. c. d.* is the Circumference of a Globe's Superficies, and *e. f. g. h.* a Plane drawn in Proportion, as 4 to 1; tho' all Ships do not bear ſuch a Proportion, but perhaps ſome more, and ſome leſs. However, ſuch a Figure may be drawn into any other Proportion.

Let this Plane then repreſent the extream horizontal Baſis of a Ship at her main Breadth, and alſo ſerve for the Riſing Line, to ſhew the Swing of the Body on a vertical Poſition: And this very Scheme may be made applicable to form every Part of a Ship's Body.

For let the Circle *f. a. b. f.* be the extream half Breadth, and the Line *F. E. G.* the lower Height of the Breadth Line, and Narrowing of the Floor Line; and let the Semicircle *I. K. L.* be the Hanging of the Sheering Line, and *B. C. K.* will be the Sheering Line, which may be made applicable to the Narrowing of the Top-timber, provided it be properly uſed. For if you deſign a Square Stern, and a broad Fore Beak, then that Diſtance of Breadth the Ship is there, beſides the circular part, ſhall be ſet off from the middle Line on the Ship's Body, as a blunt-headed Solid, by whoſe Rotation the Top-timber Line ſhall be formed. And this may ſuffice to ſhew the three tranſverſe Lines that will ſhape any Ship's Body length-ways.

The Narrowing of the Top-timber Line is *N. O. P.* being ſimilar to *B. C. K.* the Riſing Line, which ſhews the Swing of the Body, on a vertical Poſition, *E. M. H.* the Narrowing of the Floor Line being ſimilar to *F. E. G.* The Knee of the Head is alſo formed by perfect Circles, as the foremoſt round Part 4. 5. ſwept from 6. the cutting down or Sheer of the Knee 1. 3. ſwept from the Center 8. and the Back of the Lion rough 1. 2. is ſwept from 7. And after ſuch a circular Faſhion may every Rail of the Head be formed. But the Gallery is a Rhomboides, ſo that the Figure *L.* being divided into 4 Quarters, and ſubdivided again into equal Parts, draw Diagonals to thoſe Centers, and the oppoſite Quarters are to be ſet off parallel from them. The Circles *w. x. l.* turn out the Lines *E. L. G.* the Circle *Q.* the Line *F. E. g.* and *e. h. g.* and the Circle *E.* the Line *B. C. K.* For the Circles being divided into Chords, and the Planes into equal Diviſions to the Circles, as in the Circle *a. b. c. d.* let it be divided as 9-10: 11-12: 13-14: 15 & 16. Then ſet off the Diſtance of 9-10. on the Circle at 9-10. on the Plane, and the Diſtance of 11. 12. in the

Circle

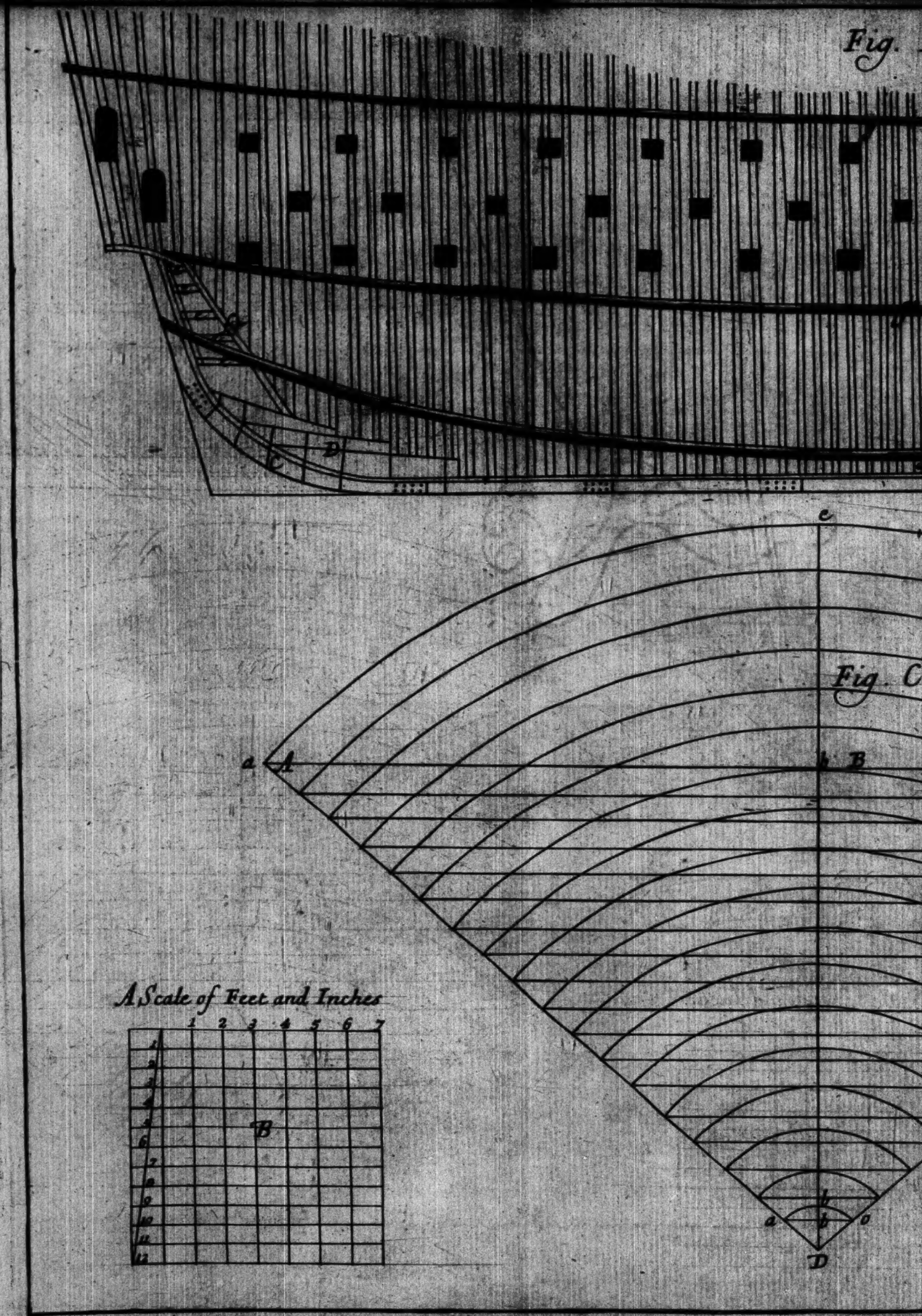
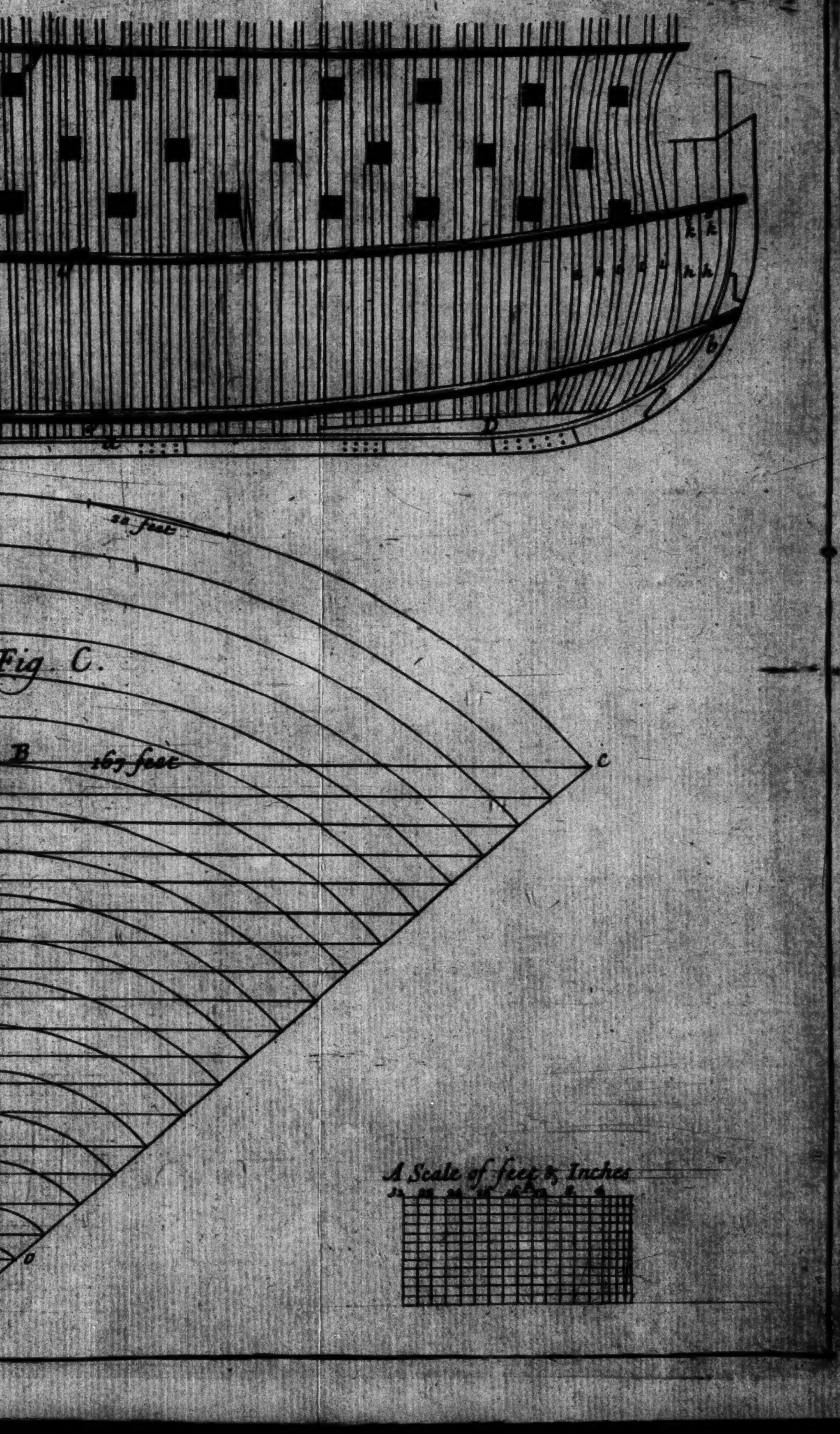


Fig.
Fig. C
a A
b B
e
C
D
a b o
A Scale of Feet and Inches
1 2 3 4 5 6 7
1 2 3 4 5 6 7 8 9 10 11 12

Fig. A.



Circle at 11. 12. on the Plane, and 13. 14. and 15. 16. accordingly. Which being reconciled, will turn those Planes into regular Curves, suitable and applicable to form any Ship's Body transverse-ways.

Fig. B. shews the Conjugates or Ribs of a Ship. And these Parts may be also formed after the same Fashion, as may be seen in the Quadrants *c. d. f.* and *a. b. e.* *e. d.* being the Narrowing of the Floor; *g.* the middle Line, the Circle *d. f.* swept from the Center *c.* and that Quadrant transfer'd to the Quadrant *a. e. d.* forms the Girt of the Ship's Body below the Breadth. *c.* is the lower Height of Breadth, and the Reason of having two Heights is, first, to make a Ship contain more burden by continuing the Breadth; It causes her to carry Sail, and renders the Top-timbers beautiful, in making the Curves both shorter and more gibous.

Fig. C. & D. imitates the Cycloids or Trochoids, tho' our Mathematicians let them down as follows. Let a Wheel or Circle *a.* be imagined to make one intire Revolution on a right Line *a. b.* so that the Point of the Wheel *a.* when it comes to the Point *b.* will describe a Curve equal to the Periphery of the Wheel that acts upon such a Line. From hence 'tis plain, that by Means of a Cycloid, a Right Line may most easily be found equal to any Ark of a Circle, or its whole Circumference; and consequently the Quadrature of the Circle may Geometrically be had, if the Cycloid be a Geometrical Curve, which the Mathematicians deny. However, Dr. *Harris* says, that the *Linea celerrimi descensus*, or the Curve which any heavy Body would describe, supposing it to descend with the greatest Swiftness imaginable, is the Ark of a Cycloid.

In Fig. C. & D. may be seen, that by equally describing the Arks *a's*, extended in as many Parts as you please, so that the Proportion of Length to the Breadth may be according to any Dimension; then by dividing the Circles *d. K. C. B.* into as many Parts as there are Arks, and by taking the Distance of every equal Part on the Circle, from the Line B. B. and setting it off on the Arks *a's*, you will describe the Curves *B. d.* And after such a manner may every circular Part of any Ship be laid down and demonstrated. But then it must be observed, such Bodies will not be of the bluntest sort, that are perfectly Parallelopipedons, with only the Corners cut off. And since such Curves are not Mathematical, they may better suit Shipwrights, that have such

an Aversion to the composing the Bodies of any Ships or Vessels by such perplexed Demonstrations as they suppose the Mathematical Curves to be.

Such Figures as are here laid down, only shew the Method for round or pink-stern'd Ships; tho' in describing the Narrowing of the Top-timber Line it may be taken for a square or broad-stern'd Ship. But without some other Considerations, broad-stern'd Ships will be found unnatural, and only regarded for Accommodation above Water. And if such Vessels were consider'd in the manner as they ought, they would be produced from such a Fashion; first by drawing the Curve to a Period, and then bisecting it at the assigned Length. And the Conveniency in such Sterns is to have Breadth to make Windows, to enlighten the Great Cabin, and other Apartments. But such Sterns ought to be very well secured with Timbers, Transoms, and Knees. The Beauty consists in the due ranging and exact curving the Rails and Brackets, and making the Galleries suitable to the Sterns, as may be seen in the Figures A. B. & C. D.

Fig. A. imitates the Stern and Gallery of a Sixth Rate. The Rails are Yellow, and Brackets Red, there being one Tire of Lights to enlighten the Great Cabin. Above and below that Light is shadowed Freez. The Gallery B. suits the Stern in Beauty and Uniformity, tho' the Gallery makes almost a Right Angle with the Flat of the Stern, when fixed on the Ship's Side. The Extreams of the Stern are a perfect Circle, and swept from the Center K. and will appear more beautiful than any other Curve whatsoever. For 'tis not to be imagin'd that a perfect Circle, swept on the Flat, will appear so to the Eye, looking on the Rake of the Stern of any Ship.

Fig. C. imitates the Stern of a three deck Ship, which is the biggest Size, the Extreams of which are much out of Proportion with a Circle, and therefore cannot be so performed. It being therefore swept by 3 Sweeps, 1, 2, and 3, the Rails *a.* are curved by diminishing. Line *a. b.* shewing that Ships Decks should increase their Heights upwards in the middle, which is the Place of the principal Acting in any Ship, for two Reasons. For first it vents the Water out of the Scuppers, and then it keeps the Deck down at the Ship's Side, causing a Ship to be snug. But the Beauty of it consists in this, that the Surface of the Water appearing to the Eye perfectly streight, and the Sky circular, by making such

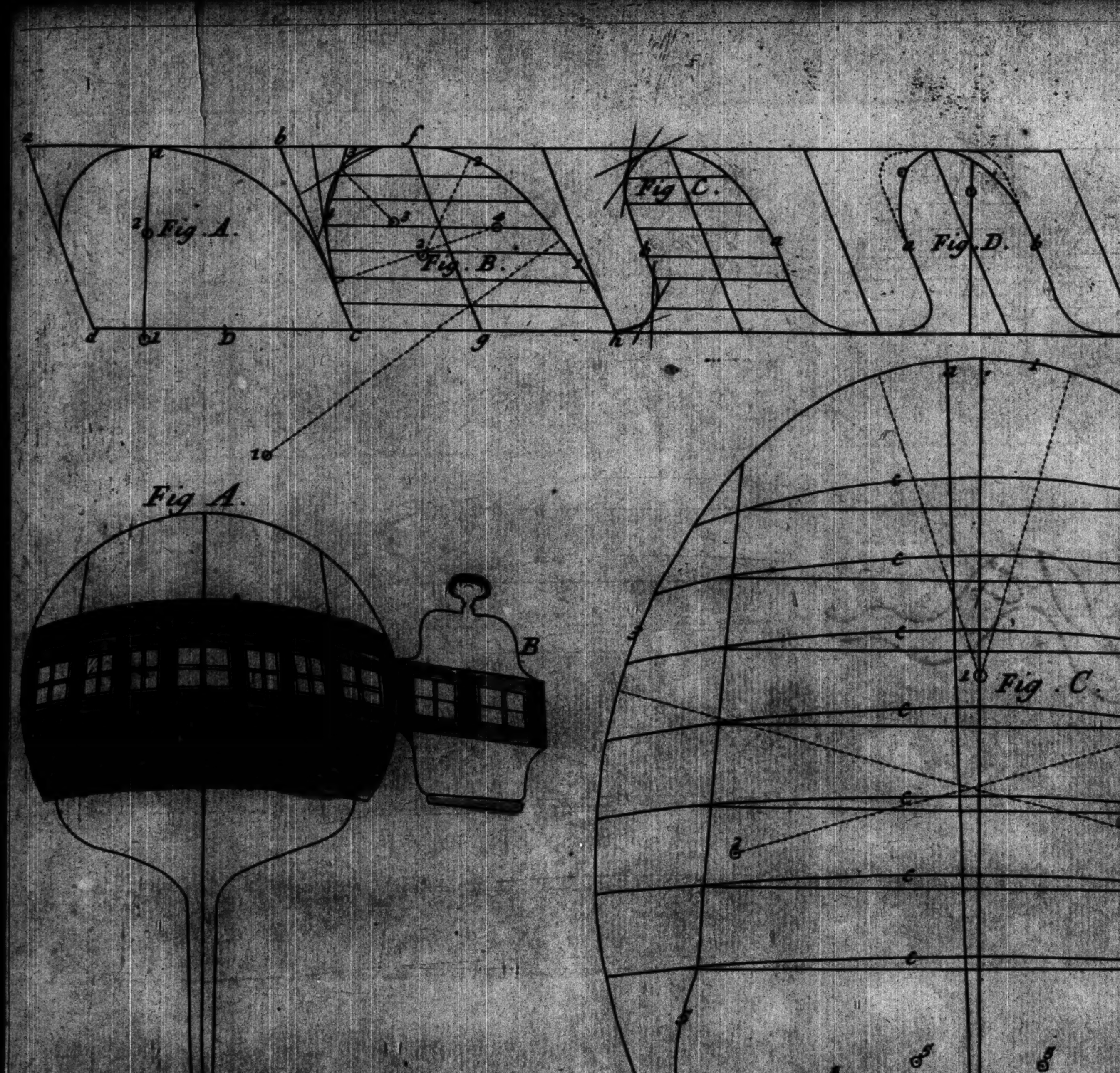


Fig. A.
Fig. B.
Fig C.
Fig. D.
Fig A.
B
Fig. C.

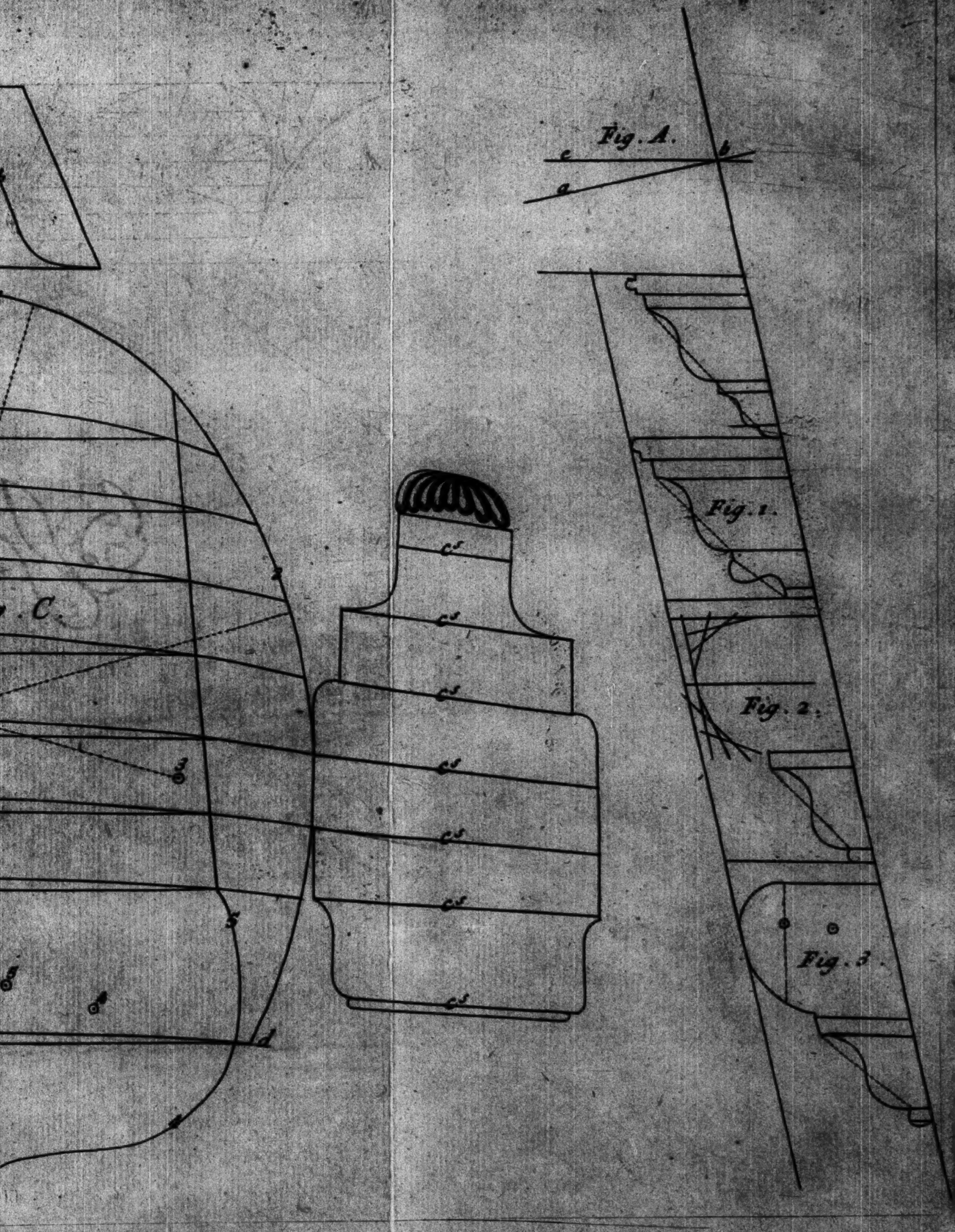
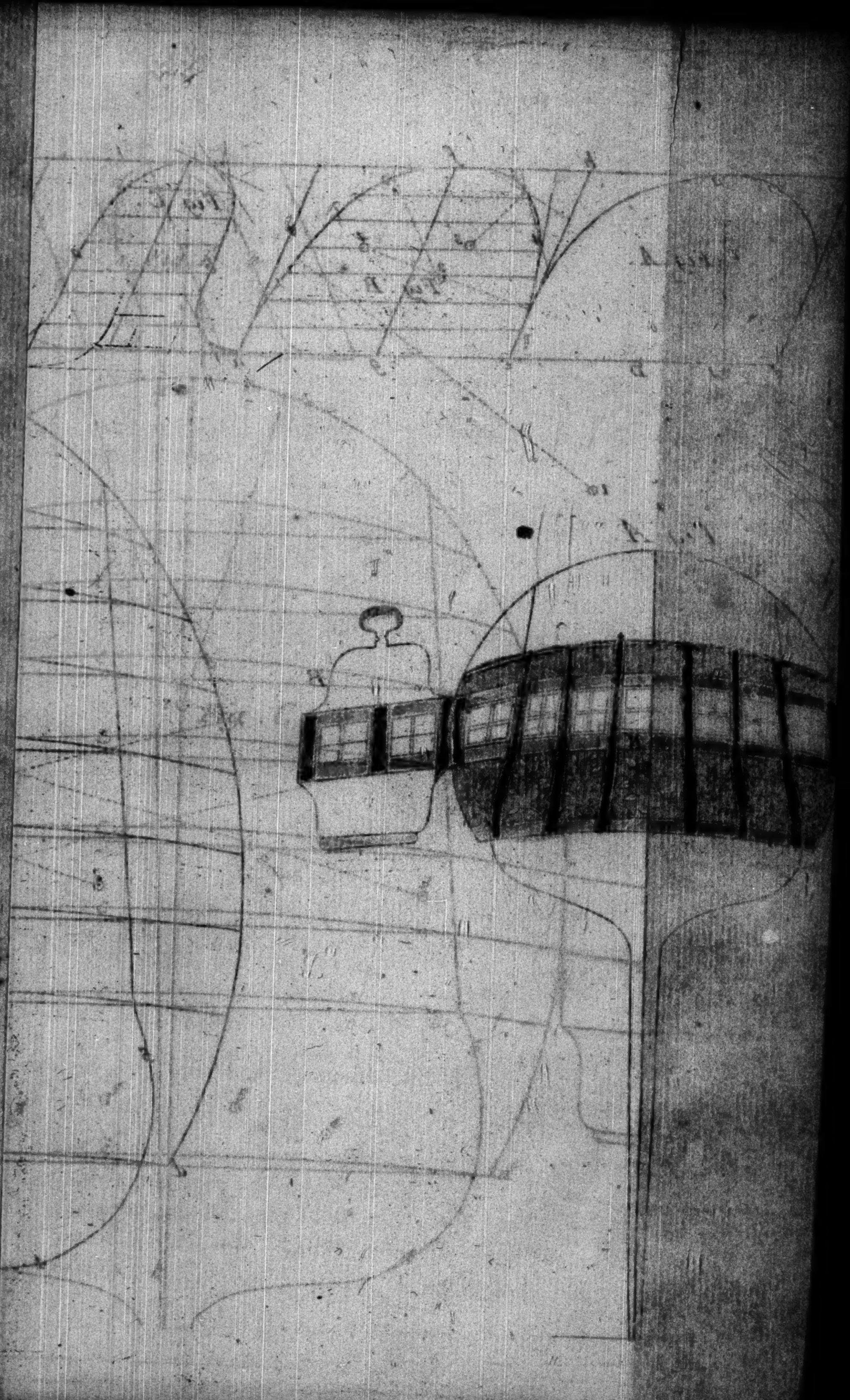


Fig. A.
c
b
a
Fig. 1.
Fig. 2.
Fig. 3.
C.
2
3
5
d



ſuch Rails round upwards, they imitate Nature more and more, and ſeem to join in a due Order and Decorum.

The Gallery Rails *c*'s are deſcribed by holding a ſtreight Ruler at the Height of your Stern Rail, in the middle of the Stern, and alſo at the Extreams, and ſo drawing a ſtreight Line for each Rail of the Gallery. But then the Round of the Stern ought to anſwer the Quickening of the Sheer of the Side, which is a Method altogether impracticable, but at one Place; ſince all the Rails of the Gallery ought to lie parallel, and the Stern Rails variouſly rounding.

d. is the upper Edge of the Wing Tranſom, and the Height of the lower Cell of the Gun-room Port; as alſo that Place where generally the extream Breadth of the Ship lies abaft. 4. 4. is the Sweep below the Breadth, and 5. 5. the Sweep above the Breadth.

The Stern of a Ship is faſhion'd as a Rhombus, raking aftward, making the Ship commodious and beautiful, as Length is always allowed to do; beſides it anſwers the Rake of the Poſt, which ought to rake for the Conveniency of Planking. Fig. A. is a Raking Arch, ſwept from two Centers, 1. & 2. bounded by a Rhombus *a. b. d. c.* which may be called the Top of a Gallery, and ſuiting the Rake of a Stern; and by letting fall the Perpendicular *e. f.* from the middle of the Line *a. b.* it deſcribes a Line where the Centers are found, 1. & 2.

Fig. B. is of the ſame nature, only deſcribed after another manner, which is, to divide the Limbs *b. f.* and *b. c.* into equal Parts, and by drawing Diagonal Lines, the Arch *f. c.* is found in their Interſection; then ſetting off equal and parallel Diſtances of that Arch from the middle Line *g. f.* the other way it deſcribes the Arch *f. b.* altho' it may be ſwept from the Centers 1. 2. 3. 4.

Fig. C. & D. are Raking Bells imitating the Top of a Gallery, and may be deſcribed as the other Arches are, only obſerving the Points of Inflexion *a.* & *b.* From ſuch Methods may any faſhion'd Gallery be formed. But to demonſtrate the Notion or Fancy of every Man in ſhaping ſuch Figures, will be really too tedious.

Fig. 1. 2. 3. are the Rails of the Stern diminiſhing upwards. It ought alſo to be obſerved, that all Rails which are placed on the Stern of a Ship, ſhould round more than what is allowed to appear in ſight, as much as the Difference is between the Rake of the

Stern.

Stern and a perpendicular Line, considered according to the Round of the Rail that you allow afterward. As in Fig. 4. you may observe, that the Line *e. b.* is a Parallel drawn from the Stern Side-timber, and the Line *a. b.* perpendicular to it. Therefore since all Stern Rails do project perpendicular from the Stern, the Difference of the Rounding would be according to the Difference between the parallel and perpendicular Lines in the rounding of every Rail.

The other Figures are the Fashion of Stern Rails imboss'd, according to some general Fashions; and whoever is desirous to be more curious, may consult the Works of our best Architects, that have writ very largely on that Subject.

The Head of a Ship serves for little else than Ornament (for several Ships have no Heads) since its chiefest Conveniency is to tack the Weather Clew of the Fore-sail forward, to gammon the Bowsprit, to water the Provision, and for Houses of Ease. As to the tacking the Foresail forward, it has a principal Use, to trim the Sail to the Wind, that the Lee Leetch may not bag, and oppose the Motion of the Ship. And then it may be considered, whether such over short Heads are proper, from the Distance there is between the Main-mast and the Chesse-tree, that tacks the Main-sail forward.

The Beauty of this Part is more admired, or Deformities discover'd sooner, than in any other. For the Heads of all Creatures are most observed by all competent Judges; and the Symmetry of the whole depends much on the Proportion or Disproportion it bears to the Head. For to see a Head with all its Parts well and neatly formed, and a due Proportion and Harmony between them, strikes with Admiration the Eye of the Beholder. From such Observations the Head of any Ship may be fashioned, so as to make it beautiful, that is, to form it perfectly circular, if the Dimensions will bear it; but if not, by Elipsis's or spiral Spades.

Fig. A. imitates the Head of a Ship of 250 Tuns. *A.* is the Stem, C. the fore Foot, or where the Stem and Keel is scarfed, the Keel at the foremost End is left big enough to bear the Stem's being let into it, besides a But left for the Gripe to join to. *b.* is the Gripe, *b.* the Knee of the Head, the principal Piece that is fastned to the Stem, with Bolts suitable for that Purpose, the Knee being scantled to suit the Stem as far as 'tis join'd to it.

But

But the foremost part of the Knee is barded away as sharp as it can conveniently be, termed a Cut-water. The upper Part of the Knee is generally two Thirds at the Lion's Breast of what it is at the biggest Part, and wrought taper. *D.* are the Cheeks, being Knees bolted through the Knee of the Head, and to the Ship to steddy the Knee.

In hewing of Cheeks this Method ought to be observed, to make a Mould to the cutting down of the Knee of the Head *D.K.L.* and prolong that Mould parallel with the Rounding or Sheer of the Harping, as far as the Cheeks are to be placed; then instead of hewing the Cheeks as customary, by putting them on their Ends, and hewing them perpendicular from the Breech, hew them by the hanging of such a Mould, which will give the true hanging of the Cheek at the Stem or Middle of the Cheek. *f.* are the Rails of the Head, the uppermost being truly circular, as are likewise all the other. Altho' the Notion among Shipwrights is, that such Rails cannot, nor ought not to be truly circular. Which I only take to be an Amusement to the young Practitioner, as in many other Cases, it being the Business of most Shipwrights to hoodwink and keep back the grand Principles of the Art from young Beginners. Such Rails ought also to diminish forward. An Inch in twelve Foot will be suitable, measured on the Circle of each respective Rail.

The upper Side of the upper Rail in the Middle ought to be level, for the Conveniency of Mens standing on them, and that the Gratings may also lie level, and out of winding with the Rails. The after Part of the Rail ought to bevel to the Cat-head, and bolted to the same, which is Red in the Figure. The foremost part of the Rail, if you square it as customary, will want Wood on the out-side, when in its place; and the Reason is from its spreading a great deal more Abaft than Afore, as may be seen in Figure C. Let *a. e.* be supposed to be the middle Line, and *e. c.* the spreading of the Rails at the After End, and *a. d.* the Spreading at the foremost End, *e. f.* being parallel to the middle Line, so that the Want in the beveling of the Rail at the foremost End is, as the Line 3. 4. to the Line 1. 2. which is chiefly caused by the Circle of the Rail. For that part of the Rail which lies level and perpendicular to the Horizon, will always be so, let the spreading of the Rail be what it will, I mean the middle part of the Rail. *g.* is Brackets, and Timbers on the inside of the Brackets,

the

the Timbers being the principal Security to all the Uſes of the Head, as the Jack-piece in particular; *e.* is the Lyon, or in ſome Ships the Figure of a Horſe, *n.* the Trail which is curved, altho' it would be better it was otherwiſe, ſince the Bolts that faſten the Timbers, Kelſon, and Standers, go through the Trail; and ſometimes for want of a due Regard, ſuch Bolts lie bare, which conſequently muſt be very prejudicial.

The Red is the Cat-head, where two or three Shivers are put, to make a Purchace to hoiſt the Anchor out of the Water, after the Cable has brought it to the Hawſe-hole. The Yellow is a Supporter to the Cat-head.

Fig. B. repreſents the Head of a Ship of 1000 Tuns, the upper Rail *a.* being curved by the Method of a Wheel or Circle. However the Center 2. ſweeps the middle Part, and 3. 4. the other two Parts, only forward the Curve is reverſed, and 5. ſweeps that which makes the Top of the Crown, tho' ſometimes the upper Rail is ended as the Arch 15. deſcribes. 10. ſweeps the Poll of the Lyon, 10. & 11. the aft Part of the Locks, 4. the Breaſt, 12. the Back. The other Parts of the Lyon are formed ſtreight before it's carved. And after ſuch a Faſhion may every part of a Lyon be rough ſhaped. 6. ſweeps the middle Rail *b.* 7. the lower Rail *c.* and 9. the Raking, or lower Part of the Supporter, anſwering the lower Rail. 8. ſweeps the upper part of the Lace, to which the upper Cheek is faſtned. 1. ſweeps the cutting down of the Knee, and 13. the foremoſt part of the Knee. After ſuch an intelligible manner may every part of any Head be demonſtrated, without ſo many confuſed and perplexed Methods as are cuſtomary. *a. b. c.* is the Shape of imboſſing the Rails; *a.* the uppermoſt, *b.* the middle, and *c.* the loweſt Rail.

To make every thing, and the Uſes in a Ship as proper and commodious as poſſible, has been the Aim of ſeveral, as well as to beautify. For a Ship conſiſts of divers Apartments, which may alſo be termed Stories, as well as in Houſe-building, or other Fabrics, only what is called Floors in one, are Decks and Platforms in t'other.

Many copious Treatiſes have been writ by ſeveral Architects concerning Rules and Methods for contriving divers ſorts of Stairs in Houſe-building; but I have met with very few that have attempted any thing of this nature for Ship-work. I ſhall therefore endeavour to give ſome plain Directions for building Stairs,

and

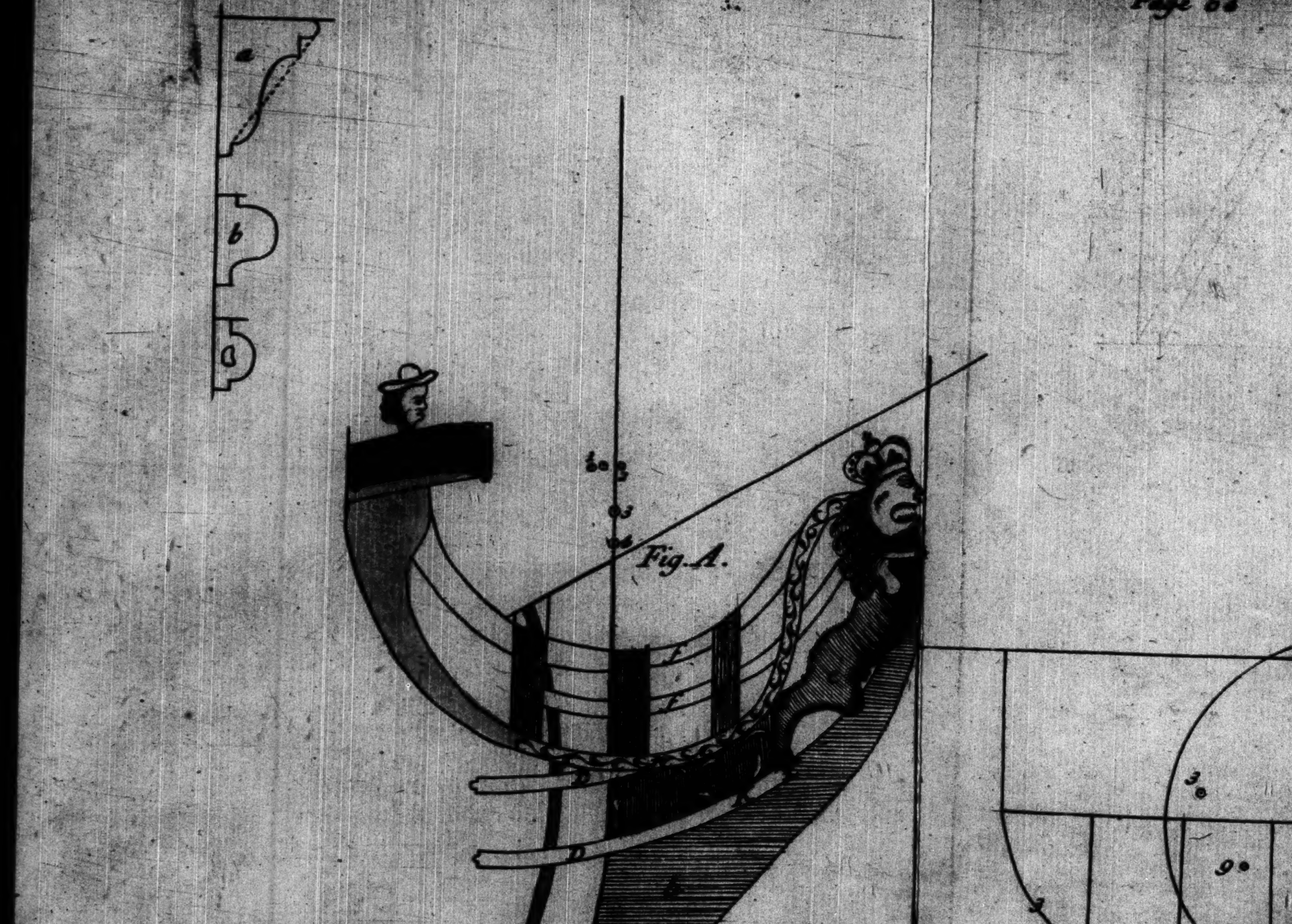


Fig. A.

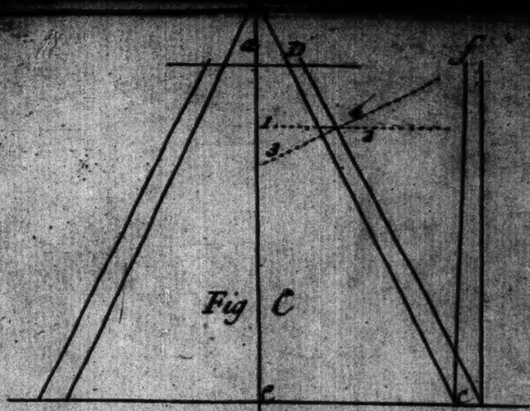


Fig C

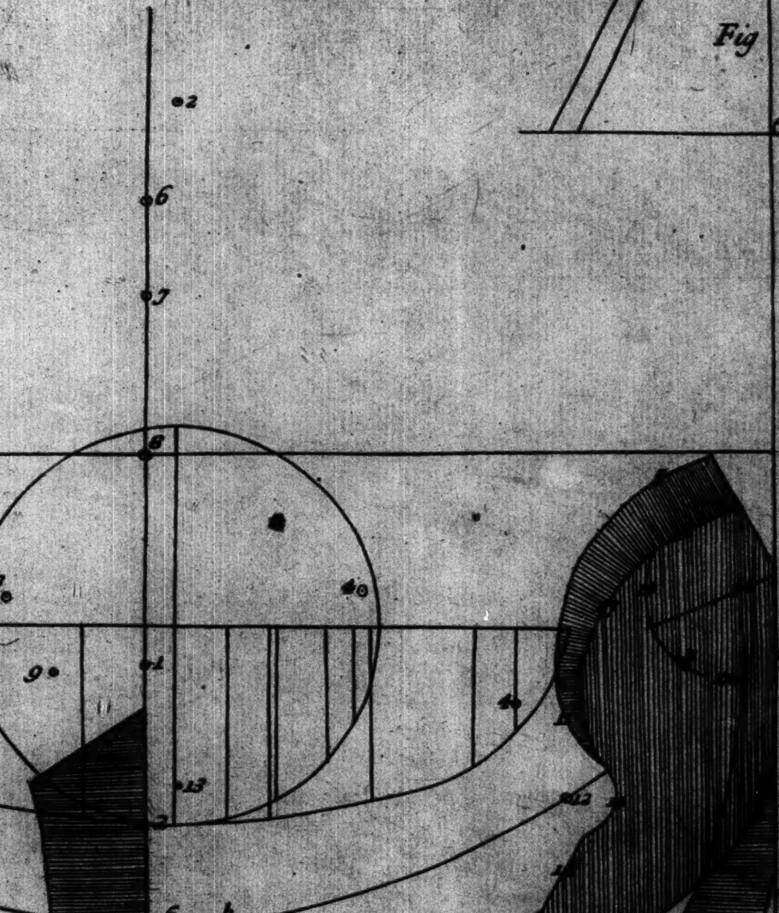
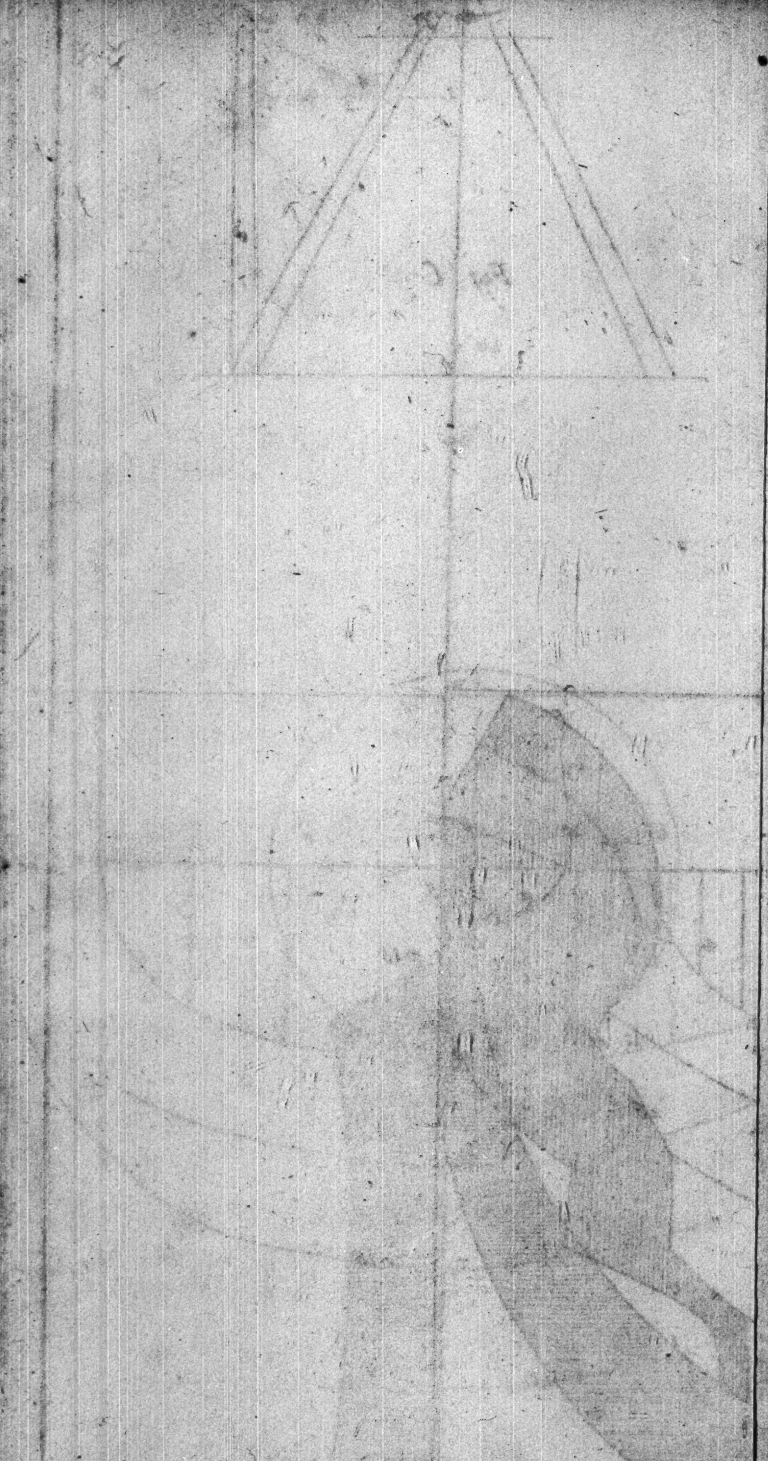


Fig. B.



and Ladders for that Uſe. Indeed the Conveniency in this Branch is very different as well as in other Parts of Ship-building, ſince Fancy has been always our chiefeſt Guide.

Stairs being much more chargeable than Ladders, are not placed on board every Ship, becauſe they are chiefly for Ornament, and if well performed, they add mightily to its Beauty. However, Frugality being the common Maxim in public Affairs, in lieu of ſuch Stairs moſt Ships (ſmall ones eſpecially) have only Ladders. I ſhall proceed neverthelеſs to demonſtrate the Nature of ſuch Stairs, with only obſerving, that the Ladders are not like common Ladders, but have Side-pieces near 9 Inches broad, and ſtand at a certain Angle, according to the Diſtance between Beam and Beam. The Sides are alſo bending by regular Curves, as may be ſeen in Figure P. The Steps are alſo rounding, as thoſe of the Stairs, but have no Riſes or Stiles, and are alſo to be moved more commodiouſly than Stairs.

Figure A. is a Pair of winding Stairs, having a Nuel in the Center, and a Side or String for the Circumference. The Portal or Clear of the Scuttle *A. B. C. D.* being pointed down on the lower Plane, where the Stairs ſtand, and a Right Square being made as in the Figure, with a Pair of Compaſſes or other Inſtrument for that Purpoſe, deſcribe the Arch *A. D.* placing one Point of the Inſtrument in *c.* Make a ſtreight Line *A. F. D.* Then obſerving the perpendicular Height between Decks, divide that Number into as many equal Parts as you pleaſe, for a Compliment of Steps; taking notice that 10 or 11 Inches ought to be the greateſt Diſtance between Step and Step. Then divide the Circle *A. D.* into as many Diviſions as you allow to have Steps, as *a. b. c. d. e. f.* and ſweeping the Arch *K. L.* from the ſame Center, divide it into the ſame number of equal Parts, as you did the Arch *A. D.* firſt obſerving to ſet off the Round of the lower Step from the Line *C. D.* to *L.* ſo that the firſt Riſe be under the upper Plane. Then with an Ellipſis or Spiral Mould, as *a. D. B.* in the Figure C. mark out all the Steps and Riſes, by running the Mould backward and forward. Then proceed to find the extream Length of the Side. And in order thereto, take the Perpendicular Height from the upper Edge of one Deck's Plank to the upper Edge of the other, and ſet off from *D.* to *G.* and from *C.* to *H.* Prolong the Bigneſs of the Scuttle to *G. H.* then draw the Diagonal Line *C. G.* which is the extream Length of the String or Side.

Then Dividing the Line *A. D.* into any Number of equal Parts, as the prick'd Lines, being perpendicular from *A. D.* divide also the Line *C.G.* into as many equal Parts, and draw perpendicular Lines, as in the other Part. Transfer the Heights of the Sweep *A. D.* to *C. G.* and find a Radius to sweep *C. m. G.* accordingly, which is the true Rounding of the String or Side in the extream Length.

Fig. B. shews the Method of demonstrating another sort of Stairs, called by Shipwrights Flying or Bell Stairs, because they somewhat resemble the Figure of a Bell, which having 2 Sides, the Work is quite different from the other, tho' in the Beginning something of the same nature.

Having pointed down the Portal on the lower Plane *A.P.O.Q.* and made a right Square, prolong the Line O. *Q.* to *R. B.* and draw the Lines *P. R. A. B.* which will give the spreading of the Sides. Describe the Circle *A.B.C.* on the middle of the Line *A.B.* and transfer that Circle into the Sweep *A.C.B.* observing that the Sweep neither interfect the Line *A. O.* nor be within it. Then set off the Rounding of the lower Step from *s.* to *H.* The exact Rounding of such a String or Step, was never, as I could hear, justly assigned, but the lower Step's Rounding would be most suitable, if the streight Lines *A. B. R.P.* were perpendicular, or made a Right Angle at the Place of Contact with the Sweep of the lower Step, or at *B. R.* Sweep the Arch *R. H. B.* which is the Rounding of the lower Step; the other Side *P. R.* must be equal to *A. B.* in every respect. In the next Place divide the Number of Steps as before mention'd, keeping to the same Height from Step to Step, after you have made equal Divisions on the Lines *A. B. P. R. G.H.* and swept every Step out from each respective Center in the middle Line *G. H.* prolonged, which compleats the Work as to the first Ground Plane. The String is prolonged according to the Method prescribed in the Winding Stairs, only observing instead of taking the Clear of the Scuttle, to take the Distance of spreading from *Q.* to *R.* or *O.* to *B.* and the Height between Decks, and draw a Diagonal Line. The String or Side is also set off according to that aforemention'd. But observe that the End Ballisters *a.* & *b.* ought to stand perpendicular from the Sides and Steps, and that the Divisions for the Steps in the Figure prolonged, are to be observed no otherwise than for Shew.

Fig.

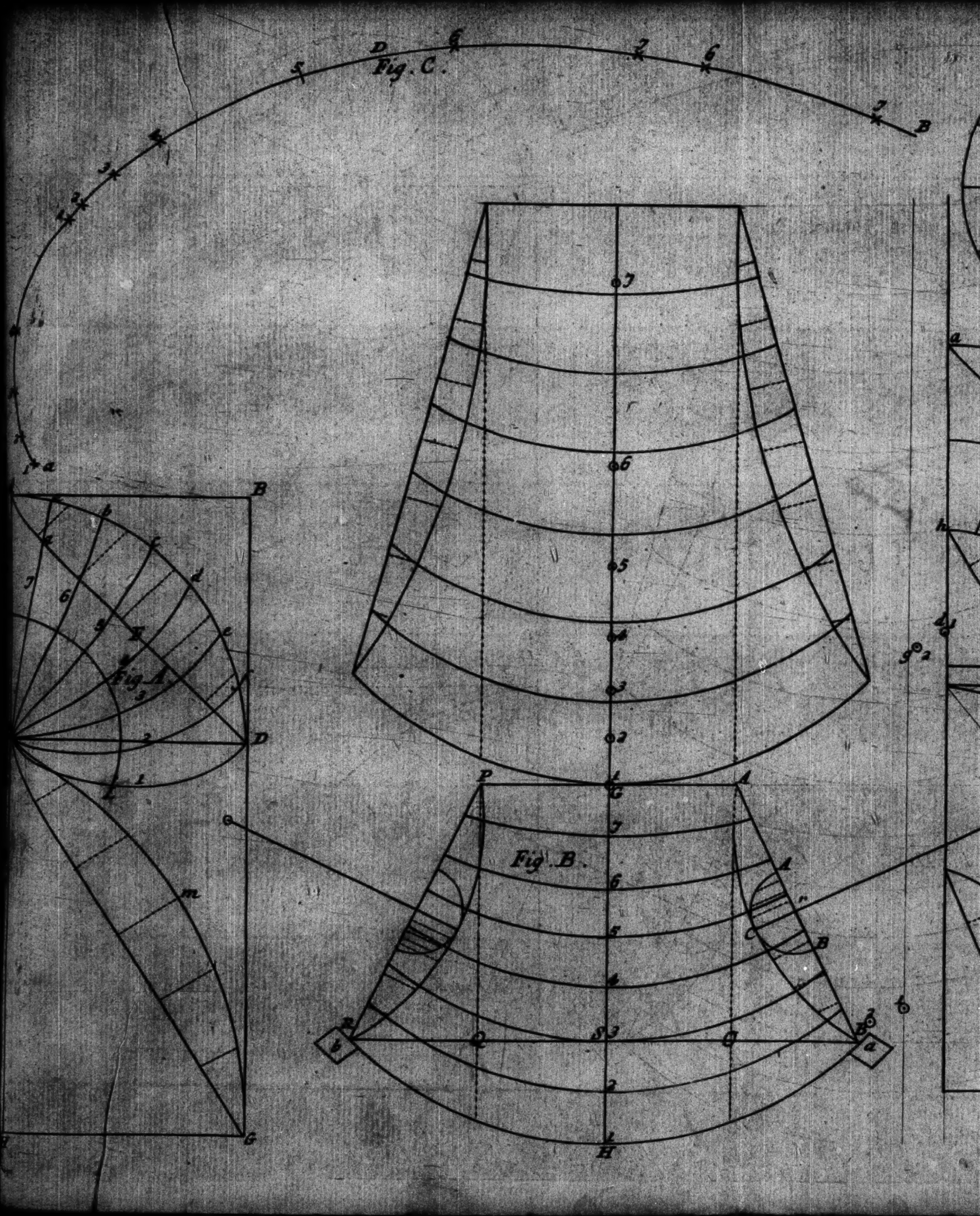


Fig. C.
Fig. A.
Fig. B.

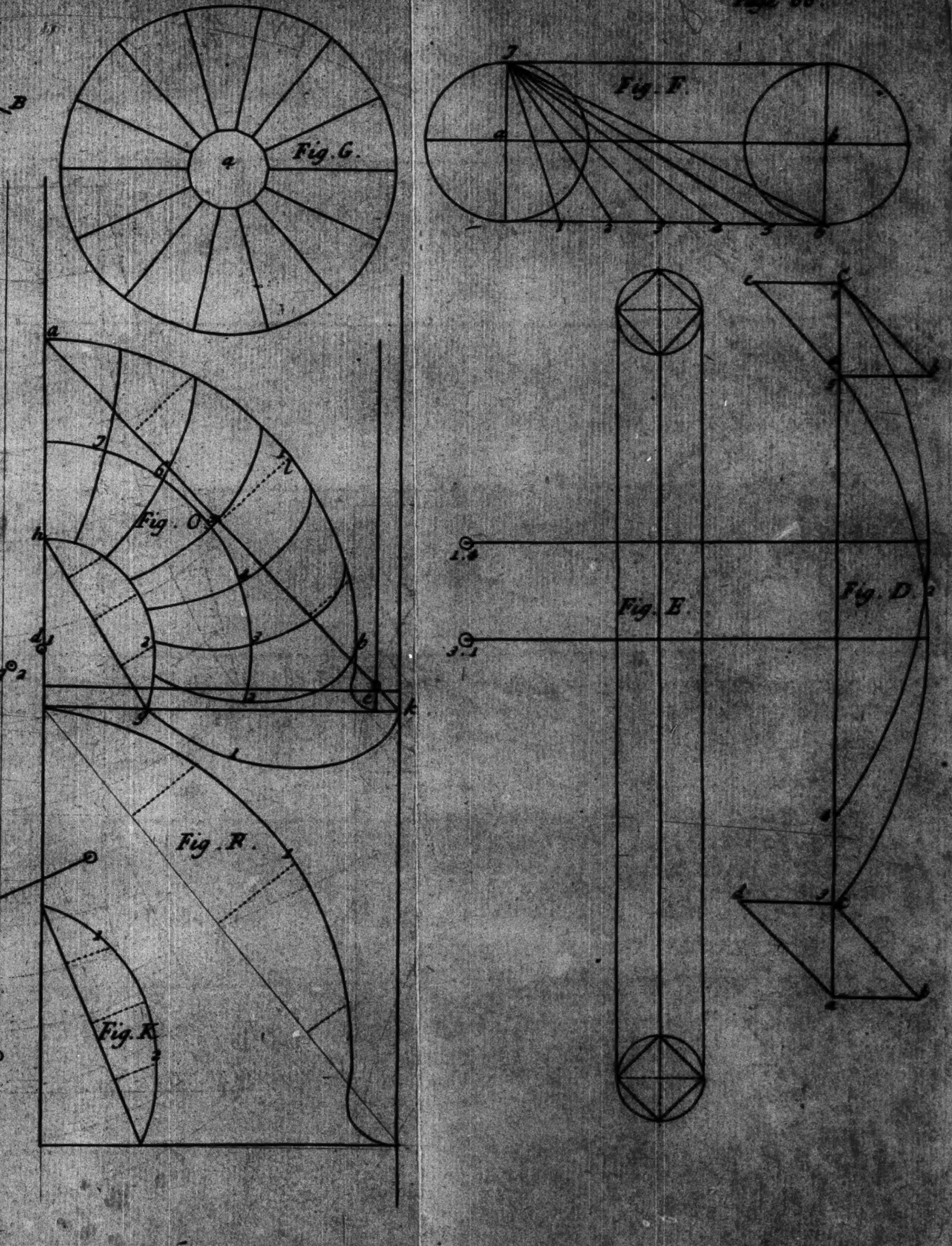


Fig. G.
Fig. O.
Fig. R.
Fig. K.
Fig. F.
Fig. E.
Fig. D.

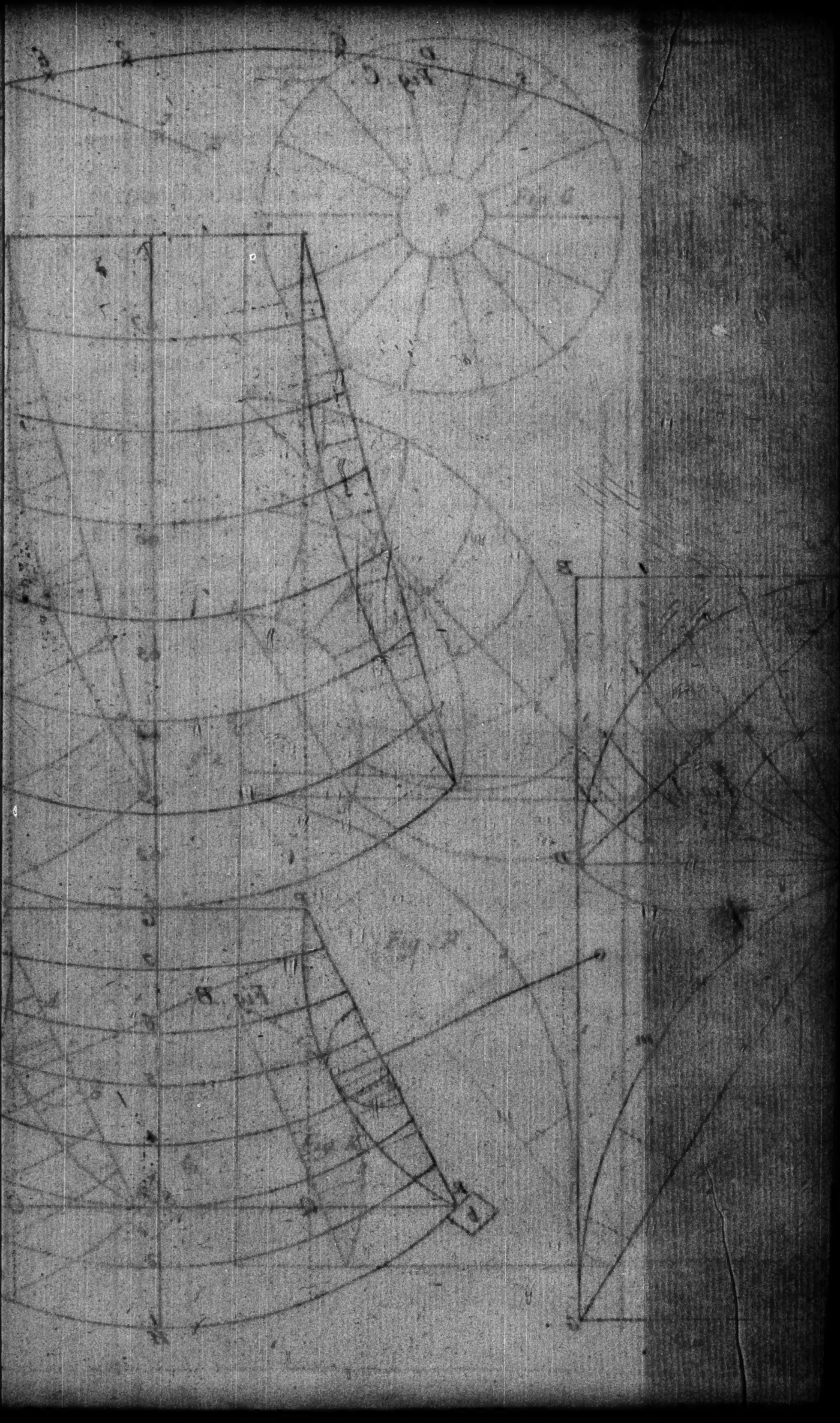


Fig. O. shews Stairs that partake of a double Property, where you may observe two Strings one within another, as *a k.* and *b. g.* not much differing from the winding Stairs, only in the Room of a Nuel there is almost a twisted String, but is wrought by the same Rule as the other, with this difference, that at the lower End of the longer String the Curve is reverted, as you may observe by *b. i. k.* which in some manner imitates the Bell Stairs: The Side *a. b.* is swept from the Center *D.* and the Center *g.* sweeps out the Side *b. d.* and in dividing the Steps, you make an equal Number of Divisions on both the Sides, *a. l. k.* and *h. i.* as also in the middle Curve 1. 2. 3. 4. 5. 6. & 7. The Striking out the Crookeding of the Steps is done with an Ellipsis, or Spiral Mould, as in the winding Stairs. The Nature of prolonging them is done after the same manner as in Figure K.

Figure D. shews the Method of Twisting or Winding the Strings in all such Stairs, as may be more fully consider'd, by cutting a Cylinder at Oblique Angles. For if the Fig. F. was a Cylinder, and put upon the Base *a.* or *b.* being perpendicular to the other Surface of the Cylinder, and then cut by any of the Lines 7.1. : 7.2. : 7.3. : 7.4. : 7.5. or 7.6. it would produce Variety of Curves. But that's not to our present Purpose, tho' such Curves would be the most natural for the Strings of such Stairs.

But what is here design'd to be mention'd, is a Method to place such Strings, to make every Rise perpendicular from the Base, which is no other than to imagine, that such a Cylinder was to be cut by any of the Slope Lines mention'd, and to divide after such a manner, that the Top and Bottom were to be taken away, leaving only behind the Breadth of such a String, or 9 Inches, and that Part must then continue in the same Position it was before the cutting of it, as in the Figure D. Let the Curves 4. 5. & 3. 1. be imagin'd to be such Curves as would be produced by cutting a Cylinder at some certain Angle, as was mention'd in the Figure F. and the Figure D. raised upon its End *a. b. c. d.* till 1. 5. & 4. 3. are perpendicular to the Horizon; it would then be the same Shape and Position as any Cylinder that was similar, and cut as aforesaid.

Therefore if the Parallelopipedon Piece *a. b. c. d.* was Timber provided to form a Side or String for a Pair of Stairs, and to be moulded by such a Curve as 4. 2. 1. then strike the streight Line 4. 3. 1. 5. and plummet that Line down at the Ends of your Piece,

making the Line *a. c.* and such another at the other End; then cant the Piece, and mark a Line on the other Side, parallel and perpendicular to 4. 3 : 1. 5. then take the Beveling of the Angle the String stands at, or the Diagonal Lines, as was aforemention'd, and set off from 4. to 3. and with the same Mould that marked the Curve 4. 2. 1. mark such another on the other side, by haling down the Mould in the streight Line 4.3 : 1.5. which will intersect at 2. which middle Part will be exactly perpendicular to the Horizon, when the Piece is hew'd or saw'd.

Fig. G. shews how a Cylinder Stair-case may be equally divided, to make all the Steps of an equal Breadth. *A.* is a Nuel in the Middle, which is round, altho' 'tis very commodious, in working up such Stairs aboard a Ship, to twist the Nuel, that every Step, as it is wrought round, may directly stand against the Square of the Nuel.

In Figure E. it may be observed, that if your Design is to work a twisted Nuel, you must first square the Piece big enough to make it round, and then a Square Twist, which may be considered from the Nature of Screw-work.

The

The SCANTLING *or Measuring of the Timbers in a Ship.*

AT the Request of some particular Gentlemen, I have annex'd the Old accustomary Scantling (or fitting every particular Part) of a Ship of near 500 Tuns, and shall refer the Reader to my Observations already laid down of the Strength and Value in different Pieces of Timber, to find the Scantlings for any other Ship from the Cube of the Tunnage.

	Feet.	Inches.
Keel of Elm in 4 Pieces if possible.		
Squar'd in the Midships	1	2
Length of the Scarph	4	1
Bolts, 8 in Number, of the Bigness	0	0 $\frac{96}{100}$
False Keel, Elm	0	3 $\frac{5}{10}$
Taper'd at the After-end thwart-ships	0	9 $\frac{2}{10}$
Stem of Oak in two Pieces, as aforesaid.		
Breadth Fore and Aft	1	2 $\frac{8}{10}$
Thwart-ships	1	0 $\frac{98}{100}$
But as big as the Bowsprit upwards.		
Length	32	
False Stem's Breadth	1	10 $\frac{8}{10}$
Thickness	0	8 $\frac{82}{100}$
Stern-post, Oak, in Length	32	
Fore and Aft } at the Head	1	5 $\frac{2}{10}$
Thwart-ships } at the Head	1	5 $\frac{3}{10}$
Fore and Aft upon the Keel	2	1 $\frac{8}{10}$
False Post Fore and Aft Alow } that within-side	1	2
False Post Fore and Aft Alow } that without-side	0	9
Fashion Pieces sided	0	10

Tran-

	Feet.	Inches.
Transoms { Wing and Deck-sided	0	11 $\frac{4}{10}$
Transoms { Those below the Deck	0	10
Common Space between	1	1
Knees of every whole Transom sided	0	10 $\frac{7}{10}$
The Wing Transom to have a long arm'd Knee	12	6
Space of Timber and Room	1	9 $\frac{1}{2}$
Floor Timber sided	0	9 $\frac{4}{10}$
Up and Down on the Keel	1	2
In and Out at the Floor-head	0	10
Length	17	2
Top-timber Length	12	8
Fore and Aft } at the Head }	0	8 $\frac{6}{10}$
In and Out } at the Head }	0	2 $\frac{6}{10}$
And all other Timbers (as Foothooks) between the Floor and Top timber head, to be scantled by a Diminishing Line struck from the Length of the Body, on the Girt set off from the Keel to the Top-timber Head.		
Foot-hooks, Number of Tires, N°. 3.		
Length	17	3
Scarph, at least	5	6
Thickness in and out at the Breadth	0	7 $\frac{11}{20}$
Lower Foot-hook short of the Keel	0	1 $\frac{4}{10}$
Every other Floor-timber to be bolted through the Keel with a Bolt in Diameter	0	1 [illegible]
Hawse Pieces in Number 4, Breadth	1	10
Keelson scor'd into the Floor-timbers	0	1
Thwart-ships	1	3
Up and down	1	2
Thick Strakes on each side the wrung Heads, N°. 6.		
The middle one in Thickness	0	6 $\frac{1}{10}$
The Extreams in Thickness	0	5
Each in Breadth	1	1 $\frac{2}{10}$
Two Strakes of middle Bands in Thickness	0	5 $\frac{7}{10}$
One Strake next the Limber Boards	0	5 $\frac{7}{10}$
Two Strakes of Gun-deck Clamps } Upper thick	0	6
Two Strakes of Gun-deck Clamps } Breadth	1	3 $\frac{1}{2}$
All the rest of the Foot-waling in Thickness	0	4 $\frac{3}{10}$
All the rest of the Foot-waling in Breadth	1	1

Orlope

	Feet.	Inches.
Orlope Beams, N°. 8,		
Fore and Aft	0	11
Up and Down	0	9 $\frac{7}{10}$
Those under the Store-rooms sided	0	8 $\frac{5}{10}$
Up and Down	0	7 $\frac{9}{10}$
Bends of Riders N°. 4.		
Floor Riders Fore and Aft	1	1 $\frac{4}{10}$
Up and down on the Keelson	0	9 $\frac{9}{10}$
In and Out at the Extreams	0	10 $\frac{9}{10}$
Length	16	11
To be bolted in every 20 Inches Space, with Bolts in Diameter	0	1 $\frac{13}{20}$
Foot-hook Riders Length of Scarph	6	6 $\frac{6}{10}$
Fore and Aft	1	1
Up and Down	0	9 $\frac{9}{10}$
Top-riders, if any, Fore and Aft	0	9 $\frac{1}{10}$
In and Out	0	8 $\frac{17}{20}$
Crutches Aft, N°. 2.		
Sided	0	9 $\frac{5}{10}$
Each Arm to be in Length	4	10 $\frac{1}{2}$
Step of the Main-mast Fore and Aft	1	11
D°. Fore-mast	1	10 $\frac{1}{2}$
D°. Mizon-mast	1	2 $\frac{2}{10}$
Breast-hooks, to place one under each Deck, one under the Hawse-holes, and in Hold before the Step of the Fore-mast, N°. 4.		
To be in Length	10	9
Depth Up and Down	0	10 $\frac{9}{10}$
To be bolted in every 20 Inches.		
The Well to be built with Oak Plank.		
Thickness	0	2 $\frac{9}{10}$
Pillars to each Beam of the Gun-deck.		
Square	0	5 $\frac{19}{20}$
Cross Pillars squar'd	0	7 $\frac{19}{20}$
Gun-deck Beams to round	0	4 $\frac{8}{10}$
To be Fore and Aft	1	1
Up and Down	0	11 $\frac{7}{10}$
To be Dove-tail'd into the Clamps	0	2 $\frac{23}{100}$
And double Knee'd.		

Each

	Feet.	Inches.
Each Knee sided	0	8 $\frac{1}{10}$
The up and down Arm of the Hanging Knee Length	3	11
The other no less than	3	4 $\frac{1}{2}$
To be bolted in every 16 or 18 Inches, with Bolts Diameter	0	1 $\frac{6}{100}$
The Beams to lie one under, and one between each Port, except in the Main Hatch-way, and in the Wake of the Main-mast.		
Clear of the Main Hatch-way fore and aft	6	8
Thwart-ships	5	8
Carlings, Tires of each side 2, and in some places less, according to the Tapering of the Ship.		
Carlings Depth up and down	0	7 $\frac{[illegible]}{10}$
Thwartships	0	10 $\frac{6}{10}$
Ledges to lie asunder	0	8
Depth	0	3 $\frac{8}{10}$
Breadth	0	4 $\frac{1}{10}$
The Flat of the Deck Oak Plank, of	0	2 $\frac{9}{10}$
Port of each Side N°. 11. fore and aft	2	8
Up and down	2	3
From the Deck Plank to the upper Part of the lower Cell	2	1
Cable Bit-pins, the aftermost square at the Head	1	3 $\frac{5}{10}$
Foremost d°.	1	1
To continue the Substance below the Beam, and then to taper half at the Heel.		
Cross-pieces one Inch deeper than the Square of the Pins, and to be fore and aft	1	5 $\frac{4}{10}$
Partners of the Main-mast	0	7 $\frac{9}{10}$
Fore-mast	0	7 $\frac{3}{10}$
Capstand and Mizon-mast	0	5 $\frac{5}{10}$
Lead Scuppers various in Number and Diameter, but of Lead that 10 Pound weight be a Foot in Measure.		
Standers, Number on each side 4.		
Sided	0	11 $\frac{6}{10}$
Spirkit-rising, Thickness	0	4
Lining between the Ports	0	3
Partners or Step for the Bowsprit	0	6 $\frac{3}{20}$

Main

	Feet.	Inches.
Main Capstand, Diameter at the Barrel	2	1
Upper Deck Clamps thick	0	4 $\frac{3}{20}$
Beams the longest to round	0	7
Fore and Aft	0	9 $\frac{4}{10}$
Up and Down	0	8 $\frac{3}{10}$
Carlings, Depth	0	5 $\frac{1}{20}$
Breadth	0	6 $\frac{3}{20}$
Ledges, Depth	0	3
Breadth	0	3 $\frac{7}{10}$
Knees sided	0	5 $\frac{9}{10}$
To be bolted in 18 Inches Square with Bolts of Diameter	0	0 $\frac{77}{100}$
Standers on each side, N°. 3.		
Sided	0	7 $\frac{7}{10}$
Plank or Deal, in Thickness	0	2 $\frac{3}{10}$
Ports Fore and Aft	2	4
Up and Down	1	11 $\frac{1}{2}$
Height from the Deck Plank to the Cell	1	6 $\frac{8}{10}$
Spirkit-rising, in Thickness	0	3
String under the Ports prick'd home to the out-board Plank. String's Thickness	0	4 $\frac{5}{10}$
And to be left without the Spirkit-rising	0	1 $\frac{2}{10}$
String above the Ports, to be scor'd ¼ of an Inch about the Timbers. Thickness	0	2 $\frac{9}{10}$
Top-sail Sheet and Jeer Bits Main, square at the Head	0	9 $\frac{5}{8}$
Long coming Carlings for the Gratings. Depth	0	10 $\frac{4}{10}$
Breadth	0	8 $\frac{7}{10}$
Bulk-head Brackets of the Steeridge and Fore-castle sided	0	7 $\frac{5}{10}$
Fore-castle Clamp of Oak in Thickness	0	3 $\frac{3}{10}$
Breadth various, according to the Height from the Fore-castle Deck to the Ports.		
String in the Great Cabin of Elm, into which the Beams shall be dovetail'd and bolted in every 16 Inches.		
Bolts Diameter	0	0 $\frac{77}{100}$
String cut on the Beveling of the Side	0	10 $\frac{1}{10}$
Depth	0	8 $\frac{7}{10}$
Thickness	0	6 $\frac{2}{10}$

	Feet.	Inches.
Beams the longest to round	0	9 [illegible]
Fore and Aft	0	7 [illegible]
Up and down	0	4 [illegible]
To lie 2 Foot, or 2 Foot 4 Inches asunder.		
Knees sided	0	4 $\frac{3}{10}$
Bolts Diameter	0	0 $\frac{63}{100}$
Plank of the Deck in Thickness	0	2
Quarter-deck Ports { Fore and Aft	1	7 $\frac{1}{2}$
Up and Down	1	6 $\frac{3}{4}$
Height from the Deck	0	11 $\frac{4}{10}$
Spirkit-rising in Thickness	0	2 [illegible]
Bits about the foremost Square	0	8
Cat-heads square, or to be 2 Inches. Bigger Fore and Aft than Up and Down.		
Square	0	11 [illegible]
To steave in every Foot	0	2
Length without the Side, according to the various Bluffness or Flaring of the Bow.		
But, as Customary	4	3 [illegible]
Poop Beams to lie asunder	1	6 [illegible]
The longest to round	0	9 $\frac{9}{10}$
Fore and Aft	0	5 $\frac{1}{10}$
Up and Down.	0	3 $\frac{7}{10}$
Ports Fore and Aft	1	8
Up and Down	1	3
Height from the Cell	0	10 [illegible]
Without Board.		
Plank wrought at the Bottom	0	3 [illegible]
To fasten well with Trenels in Diameter	0	1 $\frac{1}{4}$
Plank wrought at the Breadth, thick	0	5
At the Top-timber Head	0	2
Lower Wale, Up and Down	1	2
In and Out	0	8 $\frac{1}{2}$
Upper Wale, Up and Down	0	11 [illegible]
In and Out	0	8
Lower Chain-wale, Deep	0	8 $\frac{7}{10}$
Thick	0	4 [illegible]
Upper Chain-wale, Deep	0	8 $\frac{7}{10}$
Thick	0	4 [illegible]

Main

	Feet.	Inches.
Main Channels, Length	24	6
Breadth { At the After End	2	
Breadth { At the Fore End	1	11
Thickness	0	$5\frac{1}{4}$
Number of Shrouds,	6	
Fore Channels, Length	18	10
Breadth { At the After End	1	$8\frac{1}{4}$
Breadth { At the Fore End	2	2
Thickness	0	$4\frac{1}{4}$
Number of Shrouds	6	
Mizon Channel, Length	11	0
Breadth at the After End	1	2
Foremost End D°	1	1
Thickness	0	3
Number of Shrowds	4	
Sheering Rail Depth at the Gunnel	0	5
Stem Tire of Brackets next above the Counter	1	$\frac{1}{4}$
Quarter-pieces sided	1	6
Galery Brackets sided at the lower Lights	0	$8\frac{7}{10}$
Rudder at the Head { Fore and Aft	1	$7\frac{5}{10}$
Rudder at the Head { Thwart-ships	1	5
Fore and Aft allow	4	2
Rudder Irons, 6 Pair.		
Term Pieces or Drift Pieces sided	0	$9\frac{3}{10}$
Counter Rail to round upon the Flat of the Stern upwards	0	9
Outwards	0	$7\frac{5}{10}$
Depth	0	10
Length of the Head afore the Stem	10	5
Lower Cheek sided	0	9
Great Rail at the After End, besides the Planshire Fore and Aft	0	$10\frac{5}{10}$
Bracket against the Stem sided	0	$11\frac{6}{10}$

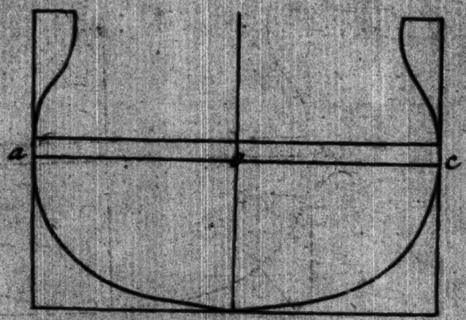
I shall further add, at the Request abovemention'd, the usual Method to measure any Ship, in order to find the Tunnage. And to make it more intelligible, I shall lay down a Figure of such a Ship as I have here scantled.

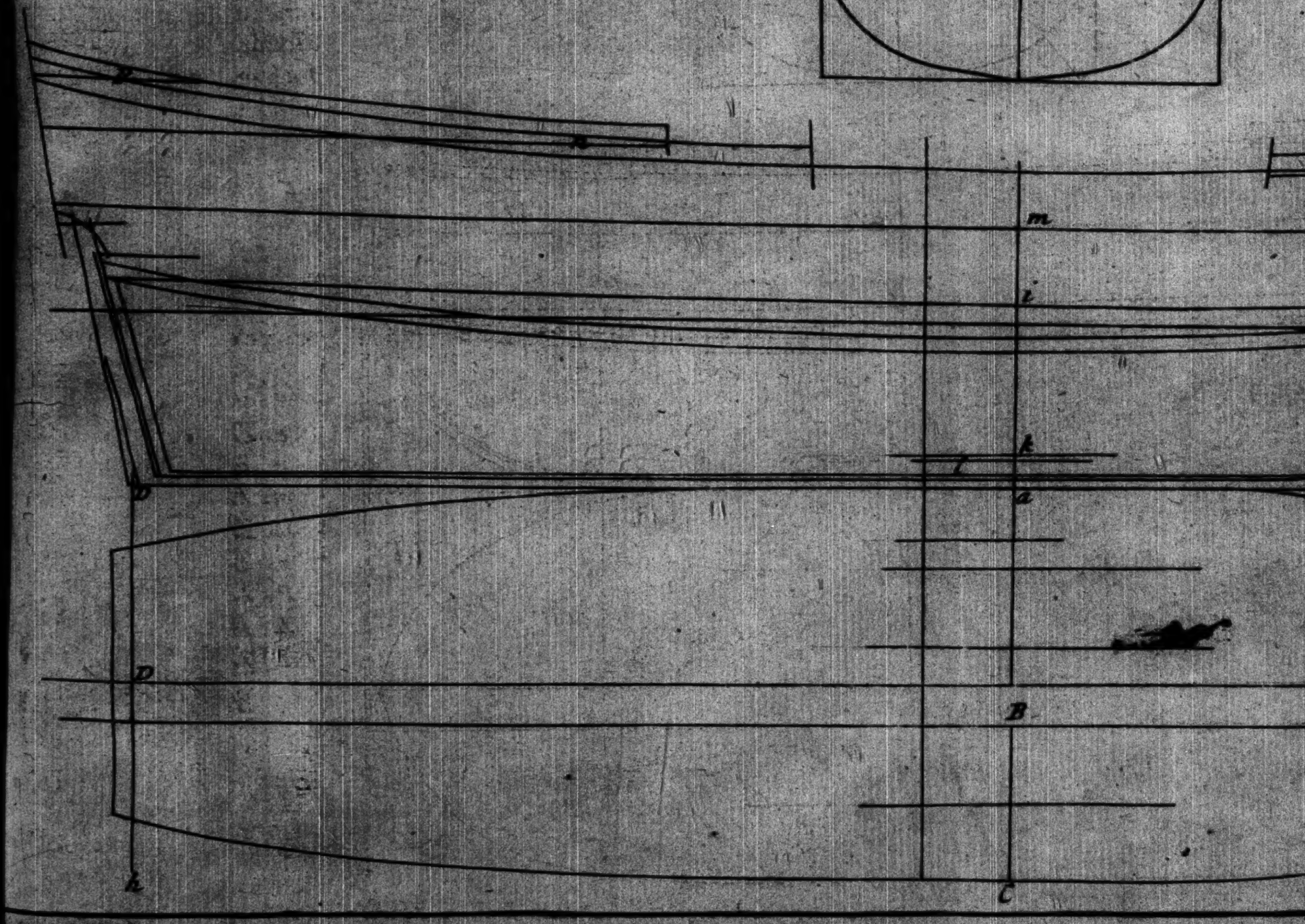
Some say the General Method, which has been pitch'd upon by the greater number of Shipwrights and others, and may be term'd Shipwrights Hall Rule, is to take the Length of the Keel, measured from the Back of the Main Post, to the Fore-side of the Stem, at the upper Edge of the lower Harping, by a Perpendicular made from thence to the upper or lower Edge of the Keel, only $\frac{3}{5}$ of the main Breadth, from the Outside of the Plank of one side to the Outside of the Plank of the other side, at the broadest Place of the Ship, being set backward or aftward from the Right Angle made by such a Perpendicular and Base. Observing also, that as several Ships and Vessels have no false Post, in such a case there ought to be allowed $\frac{1}{2}$ of the main Post from the after Part of such a Stern-Post. Then to take the extream Breadth as aforesaid, and in case the Ship heels much, to use a large Square and a long streight Staff that will reach from one Side of the Ship to the other, taking the Perpendiculars and Parallels very exactly.

The half Breadth is made use of instead of the Depth in Hold, which was formerly used; but then the Ship's Depth in Hold, and half Breadth, were very near equal; and now it is general to take the largest.

But not to enter upon Disputes, the Length as aforesaid is multiply'd by the Breadth, and again by half that Breadth, and the Sum being divided by 94, the Quotient is the Tunnage of the Ship, for either sharp or full Ships, Merchant-men or Men of War.

D.g. The Length of the Keel from the Back of the main post ⅔ of the main br
a.c. Is the Breadth from the Outside of one plank to the outside of the Other
a.o. Half that Breadth 16 ft
g.f. Is ⅔ of a.c. or is a.B. 20 feet 8/10.
But in taking the Length I have seen that in full Ships they h
Extreams fore part of the Stem as h.g. and set back ¼ of the Bread



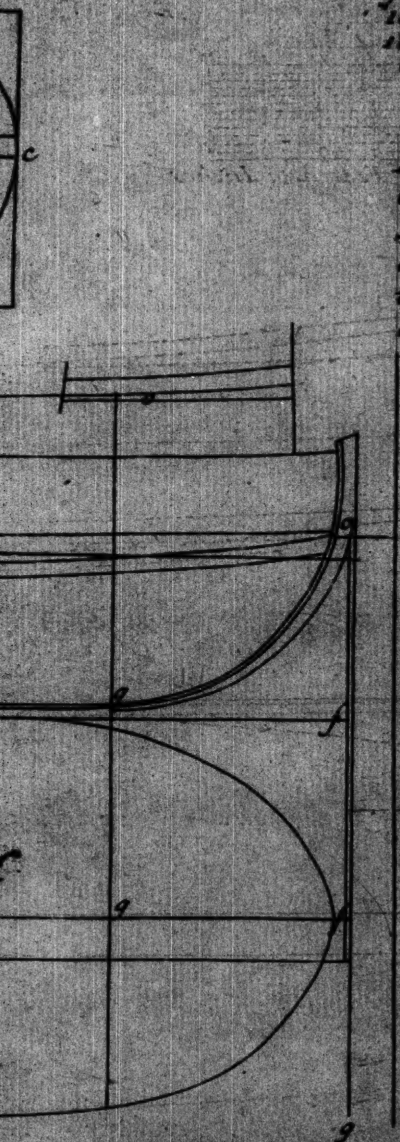


main breadth short of the uper edge of the Lower Harping . . . 56 . 0 .
Other 32

188
282
3008
16
18048
3008
48128

they have taken it to the
he Breadth from thence .

Tuns
94 (48128) 512
470 .
112
94
188
188
00



As to the Rake of the Stern Post, it was the Opinion and Custome of Old Mr Shish and his sons, all Eminent Builders, Viz: every perpendicular hight of the Stem post, set off 2 Inches & ¼ aftward, which will make A Comely Rake or Rombus .

i.k. Is the Depth in hold at the Side to which must Be added the Round of the Beam
i. The Gun deck line at the side or uper part of the Beam
m. The uper Deck Do.
n. The Quarter Deck
o: The forecastle Deck
P. The Poop Deck
k The uper part of the Limber board
l The cuting Down or uper part of the floor=timber.

Some Considerations of MOULDING *Ships Timbers.*

BY the Word Mould, as used by Ship-builders, is meant the Marking or Measuring out any Part of a Ship by a Pattern; which is seldom done but in Parts that are round or circular, for those which are streight are marked out with a Ruler.

When a Ship or Vessel is proposed to be built, the first thing mention'd is her Dimensions, as Length, Breadth, Depth, *&c.* Which Proportions produce a Strike for the Price; and then a Draught is prepared of her several Shapes, according to such a Measure of Length, and other Dimensions agreed upon. The Draught or Model is generally described on large Paper, and the Scale for the Purpose is commonly as 1 to 48, that is, the 48*th* Part of a Foot, or $\frac{1}{4}$ of an Inch: So that 'tis to be understood, that every $\frac{1}{4}$ of an Inch on the Paper is a Foot or 12 Inches on a Platform fitted for that Purpose.

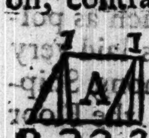
The Platform fitted for such a Design is call'd a Mould-loft; and in large Yards, where Great Ships are built, it is a spacious Floor with large and convenient Lights, disposed as much as possible for a direct Reception of the Light. The Floor is laid very smooth and even, and to render the Marks, which among Shipwrights are generally of Chalk, the more conspicuous, the Floor is wash'd over with black Size.

The Platform being prepared, the next thing is to get all necessary Conveniencies for the Purpose; as first, dry and season'd Deal fit to make the Moulds, plaining it very smooth; and then to provide the Instruments which we term Sweeps, to mark out the Curves that compose the Body. If the Place is large enough, it will not be at all improper to lay some of the transverse Lines, or the Body of the Ship, down length-ways; to lay down the Rising

Rising Line, and half Breadth Lines, or indeed all the Lines that form the Ship's Body; since it will be moulded much truer from Lines drawn at large, than from a Draught, which is but as 1 to 48, compared to the Ship's Body.

When such Lines are laid down, and the Perpendicular Lines marked on them, as may be seen in Figure A, where the Lines *a. b.* are the Perpendiculars drawn at the Standing of every Timber from Stem to Stern; then with long Staffs fitted for that purpose, as the Figures B. you mark off the Distance from the middle Line, or Line *c. d.* or else from the upper Edge of the Keel in the Figure *e. f.* to the Rising of the Floor-line, and of the Breadth, as may be seen in the Figure. When the Staves are all marked, as the Rising of the Floor, the Breadth, and Height of the Top-timber Sirmark from the Breadth, likewise the narrowing of the Breadth and Top-timber Breadth, you may rub out those Lines, and proceed to lay down the Timbers, as may be seen in Figure D.

This Figure D. imitates every Timber from Stem to Stern, which belongs to a Ship of 1000 Tuns, drawn by a ¼ Scale, as abovemention'd. If the Mould-loft be large enough, you may lay down the Timbers forward and aftward together, as may be seen in the Figure; but if otherwise, it may be done single, beginning from the Midship Flat both forward and aft; observing that the aft Side of every Timber be mark'd down forward, and the foremost Side aft. So that in moulding the Timbers, the Floor-timbers must be level'd under, (as 'tis call'd) the first Foot-hook standing, the second Foot-hook under, the third standing, and so on, contrary to the last, or Top-timber.



What is meant by the Terms Under, and Standing, may be understood by the Square A. where the Line 1. 2. is under, or hew'd away more below than aloft, and the Line 1. 3. is its Opposite; by which it appears, that whatever Timber is hew'd under on one Side, is left standing on the other, to make the Substance equal to the Midship Timber, which is always Die square.

In laying down this Body, you first mark out a streight Line *a. b.* imagining it to be a Horizontal Line, as the lower Part of any Ship (which it represents) ought directly to be; then at *c.* you raise a Perpendicular, making the Line *c. d.* exactly perpendicular

dicular from the Horizontal Line *a. b.* The Line *c. d.* represents the middle Line of the Ship, bisecting the Body into equal Halves; from which you set off the Ship's ½ Breadth each way, in order to mark out the Midship Timber. And having drawn two Lines parallel to the middle Line, with the exact Distance of the Ship's extream ½ Breadth, as the Lines *a. f. g. b.* you set off the Height of Breadth *b. i.* and upper Height of Breadth (if you approve of any) which will be *K. L.* then the Height of the Sirmark of the Top-timber *m. n.* also the Rising Line *o. p.* and the Narrowing of the Floor Line *p. r.* Then having your Sweep long enough to put one Point at *r.* with the other strike the Circle *p. i. p. b.* which will describe a Midship Bend more agreeable, and less perplexing, than if you was to chalk out 100 Segments of Circles. 'Tis said indeed that the Catahera Line will describe a Shape of the greatest Gravity; but I shall leave such nice Demonstrations at present, and proceed to shew an intelligible Method to suit and forward young Beginners.

From *b.* to *L.* and from *i.* to *K.* is streight, approved on to make a Ship stiff, or bear Sail, which is undeniably a good Faculty for that purpose. From *K.* and *L.* you describe a Segment upwards, as *k. s.* and *l. s.* which Segment is made general from Stem to Stern. From the upper Height of Breadth, you revert such a Curve from *s.* to the ½ Breadth, approved on at the Top-timber Head, which is termed the Back-sweep *s. m.* & *s. n.* And so is your Midship Timber marked out, only below, from the Rising of the Floor to the Keel, you strike a streight Line, or commence a small Hollow from the Midships forward and aft, as the Line *c. p. c. p.*

But before I proceed to lay down every Timber, I shall mark out the Mid-ship Timber separately, and set off the Scantling or Measure of the Timber, in order to make out a Bend or Suit of Moulds, of which you ought to have two Suits, one for the foremost, and the other for the after Body.

Figure E. shews such a Work. From *a.* to *b.* is the Floor-timber Mould *c. o. d. o.* being a Level Line to level the first Floor, or Seat of the Ship; and all below that is work'd down, either by a streight Line, or a hollow Mould. From *l. a.* to *i. c.* is the second Foot-hook Mould, which joins to the Floor. And for a more clear Explication of this Work, I have made another Tire of Timbers, as in Figure F. where from 2*a.* to 2*b.* is the lower

Foot-

Foot-hook, the Middle of which goes to the Head and Heel of the Floor-timber, and second Foot-hook; from *3k.* to *2c.* is the third Foot-hook, which overlaunches the 2*d* and 4*th* Foot-hook, as the lower Foot-hook doth the Floor-timber and second Foot-hook; from *1e.* to *1d.* is the Toptimber in Fig F. And it may be farther observed, that every Timber interchangeably scarphs and overlaunches each other, as was first described in the lower Foot-hook.

When two Sets of such Moulds are formed very exact, and fitted in every respect, a Preparation is made to lay down every Timber, which may be done divers ways: As, by Fastening (term'd Tacking) all the Mould together as high as the Breadth, and lifting them according to the Rising Lines *R's*, and narrowing them by the narrowing of the Breadths *N.* so that all the Body or Ribs of the Ship may be mark'd out. This Fashion is call'd Whole Moulding. But I shall lay down a more exact Way, and yet as easy. For when all the Rising Lines are laid down, and Narrowings or tapering Parallels of the lower part *L's*, then the Lines *r. M.* will afford general Centers at every one of those Intersections, either to the fore or after Body. Notwithstanding it may be observed, that the proper Floor Line aft increases in Breadth, instead of narrowing, according to the general Opinion, which is caused by a square or broad Stern; the Disproportion or Tapering being far larger between the Rising Line and the Breadth Line, than between the Narrowing of the Breadth Line and the Middle Line of the Ship.

The Centers of the Floor being pitch'd upon, the next thing is the Rising and narrowing of the Breadth, which is done by first setting off every Height of Breadth parallel to the Midship Height of Breadth Line, and also the Narrowing of the Breadth Lines *B's.* By which Intersections, caused by the Lines *B's* and *C's*, general Centers may be found to mark out every Timber fore and aft below the Breadth, provided the Ship's Body was to be a perfect Conoid. But such a Shape being not approv'd on, 'tis thought proper to carry down every Timber to the Keel, by reverting the Curve; so that having prepared another Rising Line called a Rising streight Line, somewhat below the other Rising Line, it marks out a Tangent Line at every Timber, to revert the Curve. For as the Lines *R's* are Parallels or Horizontals, so the other are upon a certain Angle between.

Then

Then making a Mould at the Timber 32, or thereabouts, and reverting the Curve at that Timber, a Mould may be made general, by which to mark out every Timber, by always guiding the streight Part of the Mould in the Lines 2's, which may be made general for working out this Ship, or any Vessel's Body fore and aft.

The upper Height of Breadth Sirmarks are obtain'd from the lower, since they are directly perpendicular one way, so that there is nothing else to do but to set up the Difference between the upper and lower Breadth Lines, on those Perpendicular Lines B's, which marks out the Line O. X. in which are the Centers to mark out the lower Sweeps of the Top-timbers.

The upper part of the Ship will be found to be more perplex'd in the Composition than the lower, which is caused by the large Accommodations in the Aft part, and the Conveniency of making the Head Rails spread, for beautifying the Ship forward, and clearing the Anchor from the Bow. However the Height of every Sirmark, parallel to the Sheer of the Ship at the lower part of the Wast Rail, is set up parallel to the Parallels of the Breadth, as the Lines 2's, and also every Narrowing at that Place, by which the Line *n. w.* and *m. w.* is found, which produces the Sirmarks, or ½ Breadth of every Top-timber. You may observe, that from those Sirmarks in the foremost Timbers, which are mark'd alphabetically, the forward Timbers are drawn directly perpendicular upwards; but in the After Body, which is number'd 1, 2, 3, the Timbers are drawn upwards from the Sirmarks, something declining from a Perpendicular, according to the Angle made by the Midship Timber. But the principal Piece of Management is to reconcile the Timbers between the Breadth and the Top-timber Sirmark, term'd working the Hollow out aft, and working one in forward. And since this is to make the Work go truly circular, according to the direct Shape of the Ship, and especially at every perpendicular Height of each respective Strake of Plank between the main Breadth and Top-timber Sirmark, it would be very proper to describe one or two transverse Lines between those Parts, and so transcribe the Breadth at such intermediate Lines, on the Lines *y. z. y. s.* and *w. s.* which will adjust the Top-timbers, and render the Work true and neat. But you must observe, first to pitch upon the Fashion of your foremost and aftermost Timber, which upwards chiefly depends

or Fancy; for some chuse to work more hollow, and some less, between the Breadth and the Top-timber Sirmark.

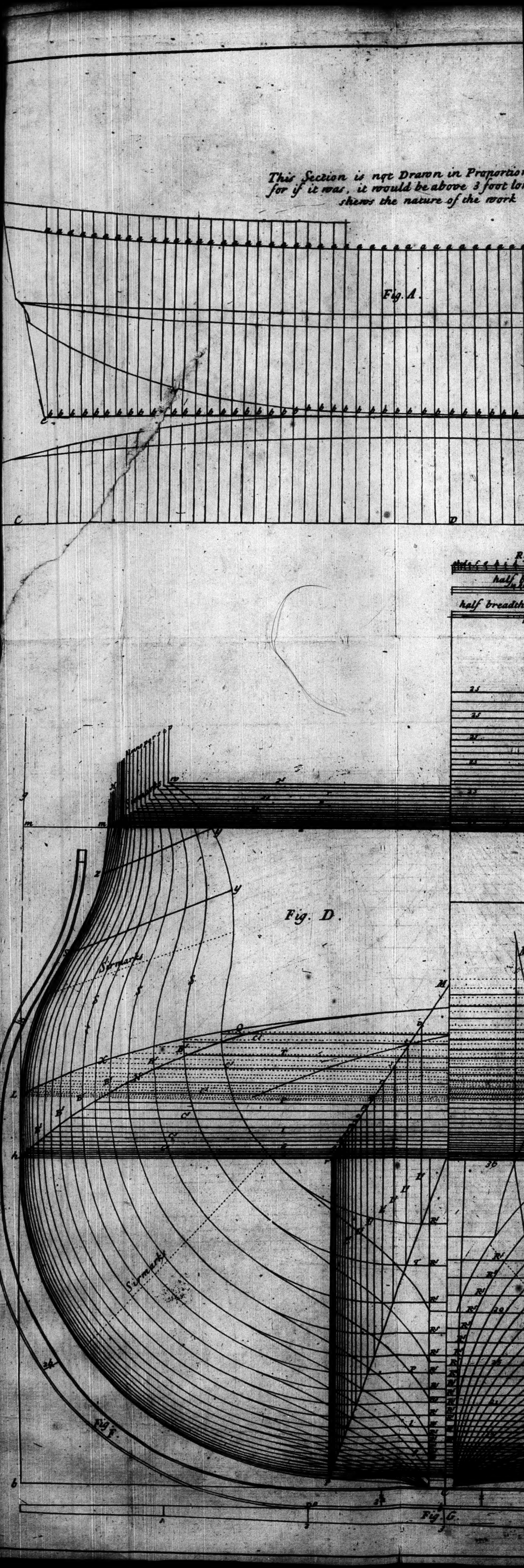
But there are so many things proper to be known, in order to work a Ship's Body, as first to draw the Draught, then to transcribe that Draught to Foot Measure (which is called laying down a Body in the Mould-loft) and afterwards to cross the Moulds, and take every Dimension proper to mould the Timber, both with Frugality in the Conversion of the Timber, and Accuracy in the Performance, that I can't but wonder it has not been more publickly look'd into. Let any one but take a serious View of the Shape of a Ship under Water, as may plainly be seen in this Figure, how every Timber turns it self in a different Form, and what a Complication of Matter is requisite in composing such a Machine; and he must needs admire how such a confused Piece of Work could be brought to Perfection.

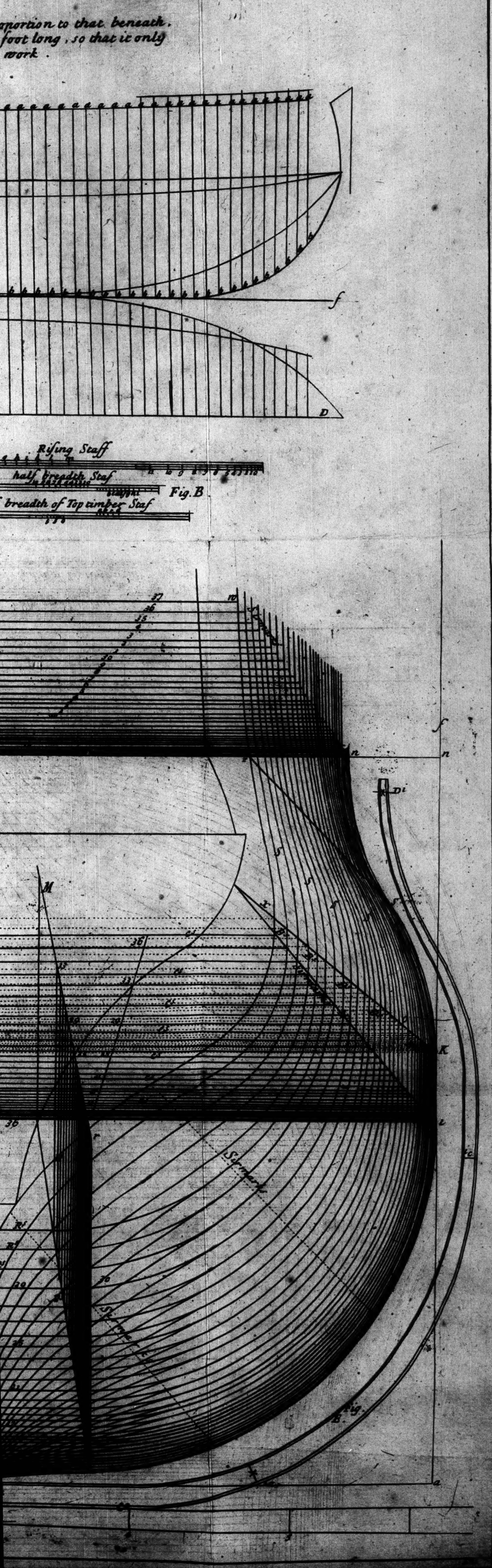
Observe that the Figures E. and F. shew the Scantling or Bigness of the Midship Timbers in and out, and that every Timber fore and aft ought to be equal to them, according to the respective Length and Breadth of every Timber, which may suffice for the Bigness of the Parts.

What is meant by the term Crossing of Moulds, is no otherwise to be understood, than from the different Shape of the Ship's Body, since the Midship Timber Moulds will not directly fit in any Place but in the Midships, or a few Timbers that differ nothing from the very Midship Timber. For as the Radius differs, they cross one another, and will not agree to the Boundings that are requisite in shaping every Timber.

However, these Midship Moulds (as may be seen in the Figures F. and E.) are made use of as far as the Breadth of the Mould will suffer to be marked, so as conveniently to be mark'd off again by such a Mould on the Timbers which are provided for the Frame. And indeed I cannot see much good Husbandry in saving a Mould, and losing a Timber, since the different Value between them is so very much; and having observed once a Mould made intire, from the Keel to the Breadth, with whole Deal for every Timber, I am of opinion that there may be as much ill Management in being over-saving in the Expence of making a few Slit-deal Moulds extraordinary from the common Custom, as the other Fashion was superfluous, since Ships Timbers are so very different in the Composition.

In


This Section is not Drawn in Proportion
for if it was, it would be above 3 foot lo
shews the nature of the work
Fig. A.
C
D
half breadth
Fig. D.
Sirmarks
Fig. G.



…portion to that beneath.
…foot long, so that it only
…work.
Rising Staff
half breadth Staf
breadth of Top timber Staf
Fig. B
Sirmark
Fig. B.

In crossing the Moulds, especial Care is to be taken to mark them at the Sirmark Lines, which are so mark'd; also to mark the Heads and Heels of every Timber, in order to shew an exact Length. The Sirmarks are placed near the Heads and Heels of every Timber, and at those Places there are Bevelings taken off, and put upon a Board fitted for that Purpose, to shew the Workman how to fit his Timber exactly to the Work. For it may be observed in the Figure, that since every Timber alters the Shape one within another, they are not exactly square, but turn themselves into different Rhombus's, according to the different tapering of the Ship's Body forward and aft.

Figure G. shews the Nature of diminishing or tapering the Timbers upwards, describing a streight Line of the Length of the Timber from the Keel to the Top-timber Head. Divide that streight Line into any Number of equal Parts, and also the Ring made by the Ship's Body into a Number of Parts equal to that; then by setting off the Bigness of the Timber at the Floor-timber Head at the other End, it will describe a Figure suitable for the Work, as in this Figure.

Diminishing Lines and Cross-lines, as they are term'd, are two streight Lines intersecting one another at one Part, according to the Use required; those two Parts in Ship-building, tho' they may be thought of little service in the Mechanic Part, yet if rightly considered and well understood, will appear extraordinary ~~useful in divers material Pieces of Work; and so would se-~~ veral others, both in the Labour and saving Materials.

It would also be very proper to try the Ribbon Lines, whether they are truly circular, according to the Shape of the Body where they are placed. Which Custom would be much better than to prove the Horizontal Parallels, or what we call making fair Water-lines; since the Plank is placed upon a Ship according to the Direction of the Ribbons, which is nearly shew'd in the Figures by the Lines mark'd Sirmark, or those drawn at Right Angles from every Segment that composes the Ship's Timbers. It also shews you the true Course of the Water by the Ship, so that a great deal of Nicety ought to be used in adjusting those Lines, to make them truly circular.

Such material Cases being truly proved, and the Body adjusted in every respect, a Mould or Pattern may be made for every Segment sufficient to mark or mould out the Timbers. And the

moulding the Timbers from such Patterns cannot be too well perform'd, but ought to be done by an able and throughly experienc'd Shipwright, both for the Preservation and good Conversion of the Timber; so that no Errors may happen, but when the Timbers are put into their Places, they may be exact and fit, according to the design'd Shape. And no Piece should be moulded streighter than its Growth or natural Grain, but as circular as possible. Neither should any Piece be taken that will work longer, or make a greater Length; but a Piece, or Chok, ought rather to be allow'd at each End within. Nor should large Pieces be applied to smaller Uses than what is requisite. Care ought likewise to be taken not to mould any Pieces that are rotten, or any way defective, both from the Consideration of the Charge of Workmens Wages, and spoiling such Pieces that might otherwise do Service for some Uses.

Hydrostatic Problems:

OR THE

MEASURE of SHIPPING

CONSIDER'D.

Being an ESSAY towards finding the TUNNAGE of any Ship.

THE Measure of a Ship may be consider'd three several Ways.

First, What the Cavity will hold.

Secondly, What superficial or solid Inches are contain'd in her.

Thirdly, What she will bear, or carry, safely from one Port to another, without damnifying the Goods so transported.

And which of these three may most properly be taken to adjust the Tunnage of a Ship, was yet never determined. But in my Opinion the last ought principally to be consider'd in measuring either Ship, Bark, or Boat.

However the Lading of a Ship is very different. Some Ships, and from some Places, are laden a great deal deeper than they are from others. And indeed some are extravagantly laden, especially Colliers.

But if such Persons sink their Craft by so doing, I cannot perceive who they can disoblige more than themselves, provided they sink in the Sea, and do not hinder or embarrass the Sailing of other Ships, or the Uses which may be requisite to the Trade of other Men.

In

In 1612. it was observed, that many Abuses and Frauds had been committed, which were then amended, and 44 Rules and Ordinances were added to the Shipwright's Charter, agreeable to the Statute of *Hen.* the vii*th*. One of them being for a Nursery to increase a Number of able Shipwrights, and to incourage that sort of People, was always accounted a thing very requisite. Since which time, and very lately too, divers Attempts have been made to regulate the imperfect Tunnage of her Majesty's Ships from the Variety of Dimensions, taken by different Hands, notwithstanding all which it has not yet been perfected.

By the Laws of Hydrostatics we find, that the Weight of a floating Body is equal to as much Water, as the immersed part takes up the room of; so that a whole Ship, and what she has in her, or that leans or weighs upon her, presses neither more nor less upon the Bottom she swims over, than as much Water as is equal in bulk to that part of the Ship which is beneath its Surface.

This may reasonably inform us how far any Ship may be laden with Safety for Sailing. For till the Ship, or what rests or presses upon her, be an Over-ballance for the Water that supports her, she will swim, and be something above its Surface; but when she becomes heavier than the Water, she will necessarily sink. But such nice Trials cannot be practised safely, there being so many other things to be considered, for qualifying a Ship to carry her Lading with Safety from one Port to another, or to traffic on such dangerous and difficult Voyages, as some, nay most Ships are often obliged to make.

Specific Gravity is the Relation which the Weight of one Body has to the Weight of another of a different Species. Thus altho' a Pound of one Body is of the same Weight with a Pound of another, as it is commonly said, that a Pound of Lead is no heavier than a Pound of Feathers; yet if you consider Lead and Feathers relatively, the specific Gravity of the former will be much greater than that of the latter, or Lead Bulk for Bulk will be much heavier than Feathers, and Gold heavier than Lead.

Dr. *Harris* acquaints us with divers Experiments of weighing Bodies in the Air and Water, and observes that a cubical Inch of Water weighs 256 Grains, or near $\frac{1}{2}$ an Ounce, and such a Cube of Oak 190 Grains, computing it in Troy Weight. He tells us also that in Weight the following Bodies are one to another in this Proportion, *viz.*

Water

Water being — 1000 Grains	Lead ——————11345 Grains
Dry Fir is ——— 546	Cork ——————— 237
Dry Elm ——— 690	Sea Water ————— 1028
Oak one Year old 870	Iron ———————— 7643

And that a Cube of Oak one Foot Square is 76 *lb.* Troy, which is to Averdupoise as 73 to 60.

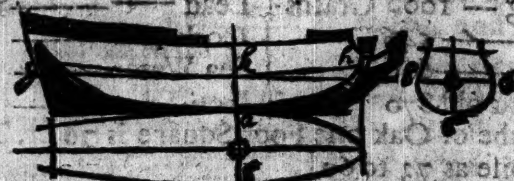
Mr. *Allingham*, in his Epitome of Geometry, has, together with the Meaſuring ſeveral other Bodies, deſcribed two good old Ways for finding the Tunnage of a Ship.

The firſt is to multiply the Length of the Keel by the Length of the Midſhip Beam, and alſo by the ½ Length of the Beam, and to divide by 94. But why 94 ſhould be a Diviſor, or the Reaſon for making ſuch a Number general, I ſhould be very glad to know.

In the next place he ſays, to take the Length of the Keel, Breadth of the Beam, and Depth of the Hold, multiplying them together, and dividing by 95, gives the true Burden for Merchant Ships; but for Men of War, which carry Guns, Maſts and Sails, the Diviſor muſt be 100. But he ſeems not to have conſider'd, that there muſt be Maſts and Sails at leaſt in Merchant Ships, without which they would be uſeleſs.

Now in my opinion it would be altogether as reaſonable to apply his meaſuring a Spheroid for a Method to find the Tunnage of a Ship, ſince a Ship conſiſts of three principal Parts, and the middlemoſt of the three Parts (which is the moſt material to Bearing) is ſomething of that Similitude. This Method would be by taking for ½ the Diameter of the Spheroid, ½ the Breadth of the Lower Deck, from out to out; and for ½ the Circumference, the Girt of the Ship's Body in the middle part, or at the Place of her greateſt Breadth, from the Height of the Gun-deck, to the middle Line on the Keel; then having multiply'd theſe one into another, multiply that Product by ⅔ of the Length on the Lower Deck, and divide by 66, ſince 66 Foot of Water is 2 Tun Weight; by which I allow ¼ the Weight of any Ship to be rather Paſſengers, and for their Uſe, than the proper Lading of the Ship. It is really very ſtrange, why there is no Reaſon given for meaſuring any Ship, ſince all other Bodies and Meaſures are brought to General Rules, as 40 Foot of Oak Timber is very near a Tun Weight, and 252 Gallons of Water is alſo near the ſame Weight.

In



In this Figure ½ of the Line *g. b.* is for the longest Diameter.
And *a. a.* or *b. o.* for ½ the shortest Diameter.
And *a. l.* or *b. l.* for ½ the Cirumference.

The Body of a Ship consisting, as I said before, of 3 principal Parts, the middlemost being a Conoid or Spheroid, is the principal Part for holding the Lading, or Goods and Provision of any Ship, and therefore 'tis called the Hold. The upper Part is for accommodating the Men, and for tacking and tackling the Rigging, Sails, and all other Utensils, as also for sailing and anchoring the Ship. The lower part may be term'd a Tangent Line to the hanging Conoid, requisite to lay the Ship a-shore, and to hang on a Rudder to steer the Ship, beng also that which principally steddys her. These three Parts properly fitted will make a compleat Ship.

But by the way, it may not be improper to observe, that any Ship may be laden with any sort of Goods, never so different in Weight or Bulk. As several Ships are laden with Wool, Cork, Tobacco, Fir-timber, and several other Bodies, which being put into the Water, will swim very buoyant. And if a Ship is loaded with Lead or Iron, or any other Body which is as much heavier than Water as the former are lighter, yet the Ship is but still loaden. But then the light Bodies will take up much more Room than those heavier, and will require much more Art to load them than the other.

From whence 'tis very plain, that any Ship, when she is laden, sinks neither more nor less, than in proportion to the Difference the Bodies she is laden with are in Weight to the Water that bears those Bodies.

Which may be understood thus: If a Ship be laden with Iron, which to Water is near as 7 to 1, or with Lead, which to Water is as 11 to 1, she will sink with the said Lading in proportion as the Weight of those Bodies are to the Water that bears them; so that the Room such Bodies take up in the Hold or Cavity of the

Ship

Ship will be but a seventh or eleventh part of what the Ship's Body takes up in the Water.

Again, if a Ship was to be laden with Cork or Wool, or any such light Bodies, Cork being to Water as 4 to 17 in Weight, her Hold would be full before she could be reasonably sunk, and fit for sailing. For no more of such Bodies press the Ship, than that part which, was the whole put into the Water, would be beneath the Surface.

As in the Figure A. let it be supposed that a Piece of Cork be put into a Vessel of Water, as B. and the Vessel fill'd to *a. b.* the Cork being put into the Water, and found to swim in proportion as 4 to 17, that is, 4 Parts of 17 being beneath the Surface of the Water *a. b.* and $\frac{13}{17}$ Parts above it, only the Part below the Surface would weigh or lean on the Vessel so as to sink her, the other Part indeed filling up the Hold, but adding nothing towards deepning her Draught of Water.

Fig. A.

Notwithstanding, 'tis not to be suppos'd, that such light Bodies strain a Ship no more than what leans on her, as to loading of her; for in divers Cases a Ship had better be laden with heavy Bodies than others that are so light and very cumbersome, as in Stowing (term'd Steaving) a Ship with Wool, there is an unreasonable Strain, according to the Custom now practised; as also in taking in large Masts, where both the Ship is forced to be cut for receiving them, and much Contrivance besides is necessary to get them in. But this not being to our present Design, I shall proceed with only this one Remark, *viz.* that a Ship laden with Masts, Cork, or any such light Bodies, take what Course you please, will scarce sink; whereas in loading a Ship with Lead, Iron, or Sea-Coal, the Custom is so unreasonable, that by the least Miscarriage, a Sea, or the like, may easily founder her.

From these Considerations, and some others, I shall endeavour to shew a very easy Method, how the Weight of any Ship may be directly known at her Launching, as also the Weight of all her Utensils, if any are willing to be so curious; likewise the Weight of the whole Ship, Men, and every thing of whatever sort, that is in her, when she is laden to the greatest Depth.

In the Merchants Service there is no general Custom in lading Ships, but it is according to the Advantage of the Owner, or Merchant; for I could never observe any Agreement between them how deep the Ship should be laden. And if a Ship be hired out, she is used according to the Judgment or Fancy of the Manager, from which there cannot be any certain deep Load-mark pitch'd on in such Shipping, where for Advantage in divers cases, they will neither mind the navigating part, or their Defence, but will shut or stow up their Guns for a little Gain.

I shall therefore shew it in the six several Rates of Men of War, in which both for the Conveniency of Swiftness and Defence, there is a general deep Load-mark always observed, as near as possible.

I begin with a Ship of 100 Guns, or the largest Size.

	Feet.	Inch.
Length on the Lower Gun-deck	170	0
Length of the Keel for Tunnage	135	0
Breadth from out to out for D°	48	0
Depth in Hold	19	7 ½

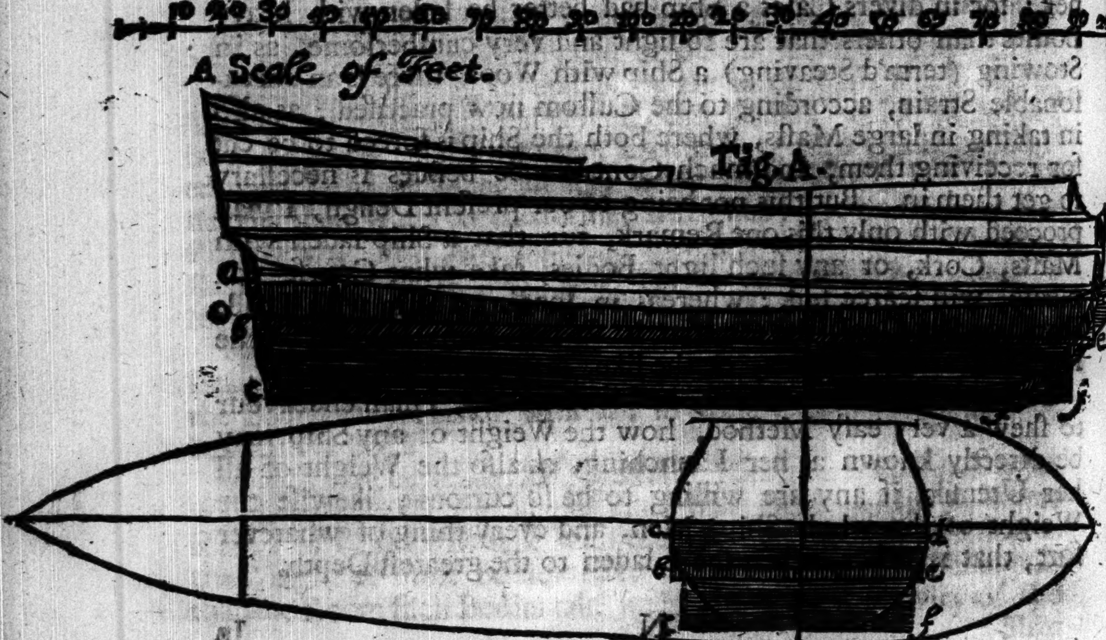


Fig. A. is a Ship of the first Magnitude, wherein may be observed, that the Line *a. d.* is termed the deep Load-mark Line, or the Place at which the Ship is divided, being a horizontal Line at the Surface of the Water, so that all below that Line is in the Water, and bears all the other Part, and whatever belongs to the Ship. This lower Body may be very well termed the Tunnage of the Ship.

But 'tis to be consider'd, whether only the Weight of the Ship is to be deducted out of the Measure of her Tunnage, and not the Masts, Sails, Rigging, Cables and Anchors, as also the Men who manage her. For if only the Ship is to be taken out, then there is nothing else to do in order to find the Tunnage, or what the Merchant ought to pay for, than to take the Difference between the light Water-mark (which is the Draught of Water at Launching) and the deep Load-mark, or the Place of the Ship's greatest Depth in the Water, when all her Goods and what belongs to her is in; and measure the Difference, which exactly gives the Tunnage of the Ship. A Method for doing this shall be afterwards described: But first I must say something concerning the Utensils.

If a Person lets out a Horse to hire, he ought to find a Bridle, Saddle, and other necessary Accoutrements, otherwise a bare Horse would not be of much Service. And so in my opinion every Utensil ought to go with a Ship, and be reckon'd to her Weight, as also the Men, being Managers, and without which a Ship would be useless. But the Guns seem to have somewhat a different Consideration, as they are equally a Security both to the Ship and Goods, and therefore it may seem most equitable perhaps for them to be divided between Owners and Merchants. But I pass this at present, designing principally to shew the vast Difference there is between the Measure of full and sharp Ships, tho' the Method in measuring and casting the Tunnage is equal in all.

I now proceed to demonstrate what the six several Rates of Men of War weigh, when they have all in, and are fit for the Sea.

In order to this, I make a Model of a Ship of 100 Guns, as was said before; which altho' it may seem very intricate and chargeable, I am yet apt to believe, that by Experience it would be found cheaper than what is now practis'd. For was such a Method introduced, once Measuring would serve for the whole.

Nor is that the only Advantage which would attend it; but there are likewise other very considerable ones, which for Brevity I must now omit. But to proceed,

I fit two Parallelopipedon Pieces exactly square, which together make up the Magnitude of the Ship under Water, from the upper Edge of the Keel to the deep Load-mark Line, as in the Figure is expressed by *a. b. d. e.* for the upper Piece, and *b. c. e. f.* for the lower, being join'd at the Line *b. e.* Those Pieces I fit to their greatest Lengths and Breadths of the Ship, at the Lines *a. d.* and *b. e.* that there may be nothing to do, but to shave them to the circular Figure of the Body. Then I weigh them in a Pair of very even Scales of equal Magnitude, exactly minding the Quantity and Quality of the Poise. Then I measure the Parallelopipedons, and see what they contain in Foot Measure, according to the Scale I make use of for that Purpose. After this I shape them according to the direct Fashion and Similitude of the Ship under the deep Load-mark Line. I then weigh them again by the same Weights before mentioned. But there will be no occasion to measure them again, for you may say, As the Weight rough is to the Measure rough, so is the Weight fashion'd off to the Measure fashion'd. Which Product I divide by 33, the Quantity of Feet contain'd in one Tun of Water, and it gives me the true and exact Tunnage of the Ship.

Sixty Pounds Avoirdupoise are equal to 73 Pounds Troy, and one Foot of Water is 62 Pounds ½ Avoirdupoise, and 33 Feet make a Tun.

Then upon weighing the Parallelopipedon Pieces with Shillings and Pence, I find them,

	s.	d.		s.	d.
The upper Piece *a. b. d. e.* —	29	0	together Rough--	54	4
The lower Piece *b. c. e. f.* —	25	4			

The Measure of the upper Piece,

				Feet:
Length————	168 ½	Feet.———	Area	80880
Breadth————	48			
Depth————	10			

The Measure of the lower Piece.

					Feet.	In.
Length————	161 ½	0	Feet.——	Area—	78126	62
Breadth————	45	0			80880	0
Depth————	10	9				

Total-159005 : 62

Upper

		s.	*d.*
Upper Weight trim'd off or fashion'd		24	9

		Feet.	*In.*		*s.*	*d.*
Deep Draught of Water	Aft	22	10	Lower	15	6
	Afore	21	0			
				Together	40	3

Then if 54 *s.* 4 *d.* give 159005 *Feet.* 62 *Inch.* what shall 40 *s.* 3 *d.* give? And it gives 117798 *Feet*, 20 *Inch.* which divided by 33, is 3569 *Tuns*, 12 *C.* 3 *qr.* 8 *lib.* the Weight of the Ship at her deep Load-mark.

Wherefore the Ship's Body under Water, (when all her Goods and Utensils are in, and fit for the Sea) contains 3569 *Tuns*, 12 *C.* 3 *qr.* 8 *lib.* neither neat nor gross Hundreds, but between, which is the Weight of the Ship, and whatever weighs or leans upon her, at 22 *Feet*, 10 *Inches* Draught of Water aft, and 21 *Feet* afore.

I now proceed to shew the Weight at her Launching.

In order to this, I fit a Parallelopipedon Piece of Fir, at the greatest Length and Breadth, at the Line *O. P.* and the Thickness to be between that Line and the Keel, and having measur'd and weigh'd it, as was said before, I find it as follows.

		Feet.	*In.*		*Feet.*	
Measure	Length	163	9	Area	98127	$\frac{18}{100}$
	Breadth	47	0			
	Depth	12	9			

	s.	*d.*		*s.*	*d.*
Weight rough	36	6	Fashion'd off	24	8

Then if 36 *s.* 6 *d.* give 98127 *Feet*, 18 *Inches*, what shall 24 *s.* 8 *d.* give? It gives 66296 *Feet*, 3 *Inches*, which divided by 33, is 2008 *Tuns*, $\frac{97}{100}$ or 19 *C.* 2 *qr.* the Weight of the Ship at her light Draught of Water.

Weight

Weight of Utensils in such a Great Ship of 48 Feet broad, &c.

	Tuns.	C.	qr.	lib.
Guns 170 $\frac{4}{10}$. The Half is	85	4	0	0
The Anchors	17	18	0	0
Standing and running Rigging, Hawsers and Cablets	31	18	2	14
Cables of every sort	32	4	0	0
Masts and Yards of every sort	80	14	0	0
Sails and Blocks of every sort	48	3	0	0
716 Men at 14 Men to a Tun	51	2	3	10
Total	347	4	1	24

The customary Method to cast the Tunnage is to multiply the Length of the Keel by the Breadth from Out to Out, and again by half the Breadth, and divide by 94, which gives the Tunnage thus:

× 135 by 48, 'tis 6480, which × by 24 makes 155520. This ‖ by 94, is 1654 *Tuns*, $\frac{46}{100}$.

Note, That the Character × stands for Multiply, *and this* ‖ *for* Divide.

	Tuns.	C.	qr.	lib.
The Weight of the Ship at her Light-mark	2008	19	2	26
Weight of Utensils and Managers	347	4	1	24
Total	2356	4	0	22
The Weight of the Ship at her Deep-mark	3569	12	3	8
Which substracted, leaves the Lading	1213	8	2	6
The Tunnage as customary	1654	9	1	0
Difference	441	0	2	22

From which it may be observed, that a Ship of this Magnitude doth not properly carry her Tunnage, according to what she is rated for, by above 400 Tuns, $\frac{4}{15}$ Parts being left out of her Lading. And therefore instead of making use of 94 for a Divisor, it ought to be 128.

		Feet.	*Inches.*
Draught of Water light	Afore	13	6
	Aft	16	4

Figure

Fig. C.

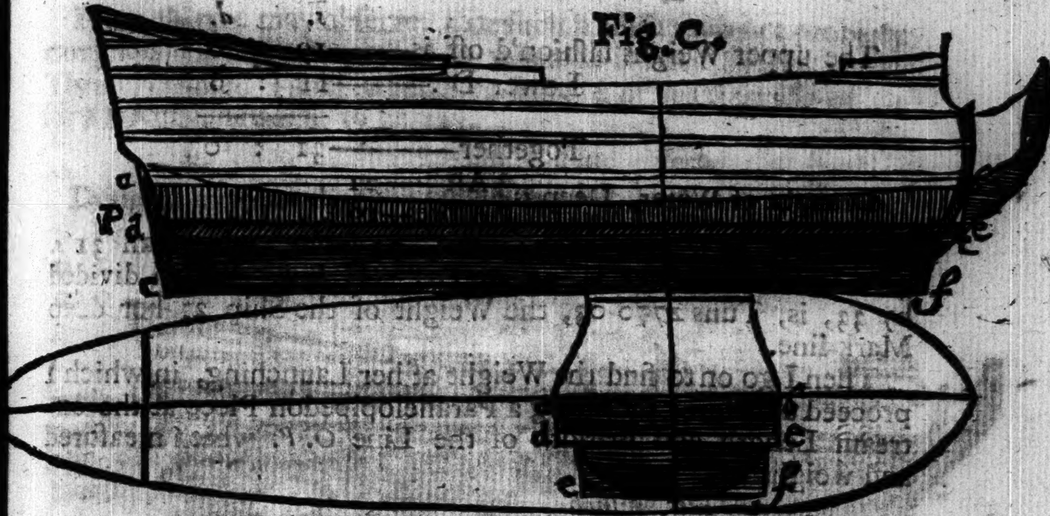


Figure C. is a Ship of the Second Rate, or Size, carrying 90 Guns.

	Feet.	Inch.
Length on the Lower Gun-deck — — — — —	165	0
Length of the Keel for the Tunnage — — —	133	6
Breadth from Out to Out for D° — — —	45	0
Depth in Hold — — — — — — — —	18	3

And making use of the aforesaid Method, by fitting two Parallelopipedon Pieces between the Lines *a. d. b. e.* and *b. e. c. f.* I measure and weigh them, and find their Weight,

	s.	d.	
Upper Piece *a. d. b. e.* ——	23	3	Together rough 44 *s.*
Lower Piece *b. e. c. f.* ——	20	9	

Measure of the upper Piece,

	Feet.	Inch.	
Length ——	165	9	Area — 68750 : $\frac{43}{100}$ Feet.
Breadth —	45	0	
Depth ——	9	4	

Measure of the lower Piece,

Length ——	157	0	Area — 60994 : $\frac{50}{100}$ Feet.
Breadth ——	42	0	
Depth ——	9	3	68750 : 43

Total - 129744 : 93

The

		s.		d.
The upper Weight fashion'd off, is	—	19	:	6
Lower D^o.	—	11	:	6
Together	—	31	:	0

Draught of Water, Deep is { Aft——21 / Afore——19 $\frac{1}{2}$

Then if 44 *s.* give 129744 *Feet*, 93 *Inches*, what shall 31 *s.* give? The Answer is, 91411 *Feet*, $\frac{17}{100}$ *Inch.* Which, divided by 33, is, Tuns 2770-03, the Weight of the Ship at her deep Mark-line.

Then I go on to find the Weight at her Launching, in which I proceed as before, by fitting a Parallelopipedon Piece at the extream Length and Breadth of the Line *O. P.* which measured and weighed is,

	Feet.		Inch.		
Length	157	:	9	}	*Feet.*
Breadth	42	:	6	}	Area—76496 : $\frac{91}{100}$
Depth	11	:	5	}	

Weight rough 24 *s.* 1 *d.* Fashion'd off 14 *s.* 9 *d.*

Then if 24 *s.* 1 *d.* give 76496 *Feet*, $\frac{91}{100}$ *Inches*, what will 14 *s.* 9 *d.* give? The Answer will be 46857 *Feet*, 12 *Inches*, which divided by 33, is 1419 *Tuns*, $\frac{73}{100}$ or 14 C. 2 *qr.* 5 *lib.* which is the Weight of the Ship at her light Mark-line, or Draught of Water.

Then × 133-6 by 45, it makes 60075, × by 22-6, 'tis 1351-68-75, ‖ by 94, 'tis 1437 *Tuns*, and $\frac{98}{100}$, or 19 C. 20 *lib.* the Tunnage according to Custom.

	Tuns.	C.	qr.	lib.
The Weight of the Ship at her Launching	1419	14	2	5
The Weight of Utensils and Managers	270	0	2	20
Total	1689	15	0	25
The Weight of the Ship at her deep Mark	2770	3	1	12
Which substracted, leaves the Lading	1080	8	0	15
The Tunnage as customary	1437	19	0	20
Difference	357	11	0	5

From

From this we may observe, that such a Ship doth not properly carry her Tunnage according to what she is rated for, by above Three Hundred Tuns; wherefore instead of making use of 94 for a Divisor, it ought to be 125.

		Feet.	Inch.
Draughts of Water light	Afore		
	Aft		

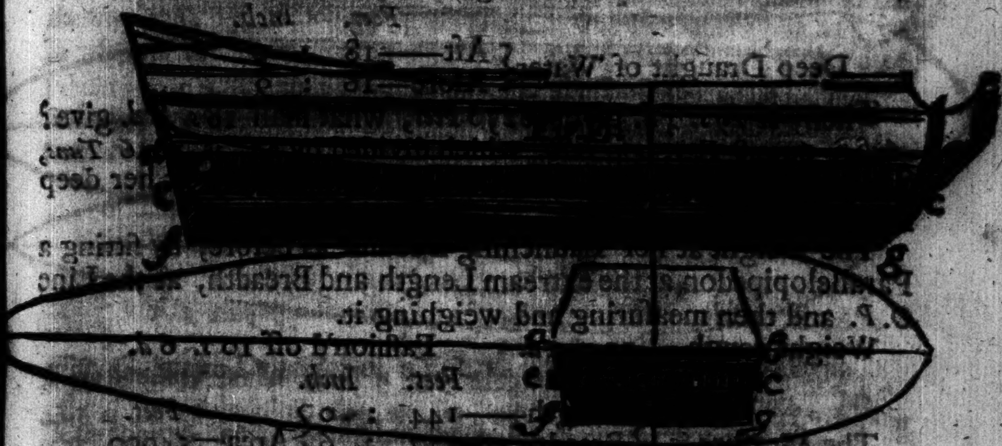


Figure E. represents a Ship of the Third Rate, carrying 70 Guns.

	Feet.	Inch.
Length on the Lower Gun-deck	150	0
Length of the Keel to cast the Tunnage	126	0
Breadth from Out to Out for D°	40	0
Depth in Hold	16	8

And continuing the Method of fitting two Parallelopipedon Pieces between the Lines a b e c. and e c f g. I measure and weigh them.

		s.	d.	
Weight of the	Upper Piece a. b. e. c.	15	6	Together 29 : 3
	Lower Piece e. c. f. g.	13	9	

		Feet.	Inch.	Feet.
Measure of the upper Piece.	Length	148	0	Area—47360
	Breadth	40	0	
	Depth	8	0	

Mea-

Measure of the lower Piece,	Length — [illegible]	[illegible]	Area — 3960 [illegible]	Feet.
	Breadth —	[illegible]		47 [illegible]
	Depth —	8 : 0		
			Total — 8[illegible]6	

	s.	d.
The upper Piece fashion'd off —	[illegible]	[illegible]
The lower Piece D° —	6 :	8
Together —	18 :	8

		Feet.	Inch.
Deep Draught of Water	Aft —	18 :	[illegible]
	Afore —	16 :	9

Then, if [illegible] give [illegible] *Feet*, what shall 18 *s.* [illegible] *d.* give? [illegible] 6 *Tuns*, [illegible] her deep [illegible]

The Weight at her Launching is found as before, by fitting a Parallelopipedon at the extream Length and Breadth, at the Line *O.P.* and then measuring and weighing it.

Weight rough — [illegible] *d.* Fashion'd off 10 *s.* 6 *d.*

		Feet.	Inch.		Feet.
The Measure is	Length —	144 :	0	Area —	54000
	Breadth —	37 :	6		
	Depth —	10 :	0		

Then if 19 *s.* 1 *d.* give 54000 *Feet*, what shall 10 *s.* 6 *d.* give? It gives 29076 *Feet*, 49 *Inch.* which divided by 33, is, *Tuns* 900, [illegible], or 3 *C.* 3 *qr.* 8 *l.* the Weight of the Ship at her light Mark-line, or Draught of Water.

Then × 126 by 40, it makes 5040, which × by 20, is 100800, and divided by 94, is 1072 *Tuns*, [illegible], or 6 *C.* 3 *qr.* 5 *lib.* the Tunnage according to Custom.

	Tuns.	C.	qr.	lib.
The Weight of the Ship at her Launching —	900 :	3 :	3 :	8
The Weight of Utensils and Managers —	168 :	3 :	1 :	0
Total —	1068 :	7 :	0 :	8
The Weight of the Ship at her Deep-mark	1846 :	6 :	1 :	8
Which subtracted leaves the Lading —	0777 :	19 :	0 :	20
The Tunnage as customary —	1072 :	6 :	3 :	5
Difference —	294 :	7 :	2 :	13

Hence

Hence 'tis observable, that such a Ship doth not properly carry her Tunnage, according to what she is rated for, by above two hundred Tuns, or near three hundred; and therefore instead of making use of 94 for a Divisor, it should be 130.

		Feet.	*Inches.*
Draught of Water light	Afore	10	6
	Aft	13	6

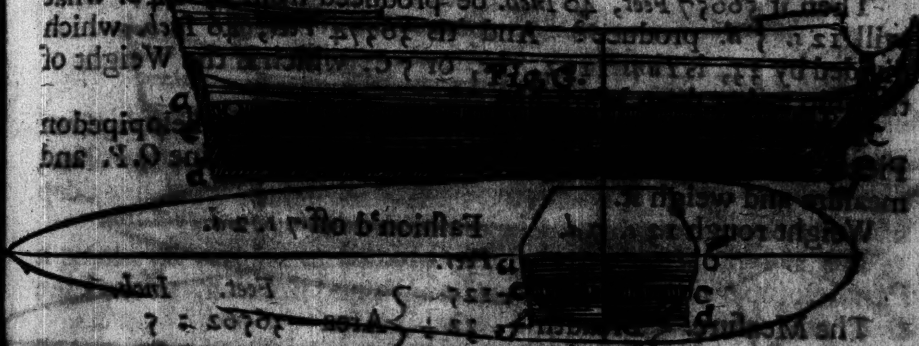


Fig. G. is the Draught of a Fourth Rate, carrying 50 Guns.

	Feet.	*Inch.*
Length on the Lower Gun-deck	130	0
Length of the Keel to cast the Tunnage	107	0
Breadth from out to out for D°	34	0
Depth in Hold	13	6

And fitting two Parallelopipedon Pieces between the Lines *a. b. c. c.* and *c. c. f. d.* I measure and weigh them.

Weight of the	Upper Piece *a. b. c. c.*	11 : 4	together 19 : 4 *d.*
	Lower Piece *c. c. f. d.*	8 : 0	

		Feet.	*In.*	*Feet.*
Measure of the upper Piece	Length	128	9	Area [illegible]
	Breadth	[illegible]	[illegible]	
	Depth	7	6	
D° of the lower Piece	Length	[illegible]	[illegible]	Area 23826 [illegible]
	Breadth	39	6	
	Depth	6	4	
				Total-56657-40

The upper Piece fashion'd off	8	:	[illegible]
The lower Piece D°.	4	:	[illegible]
Together	12	:	5

		Feet.		Inch.
Deep Draught of Water	Aft	15	:	9
	Afore	14	:	7

Then if 56657 *Feet*, 40 *Inch.* be produced from 19 *s.* 4 *d.* what will 12 *s.* 5 *d.* produce? And 'tis 36374 *Feet*, 46 *Inch.* which divided by 33, is *Tuns* 1102, [illegible], or 5 *C.* which is the Weight of the Ship at her deep Mark-line.

To shew the Weight at her Launching, Lift a Parallelopipedon Piece, at the [illegible] the Line *O. P.* and measure and weigh it.

Weight rough 13 *s.* 7 *d.* Fashion'd off 7 *s.* 2 *d.*

		Feet.		Feet.	Inch.
The Measure.	Length	125	Area	36562	5
	Breadth	$32\frac{1}{2}$			
	Depth	9			

Then if 13 *s.* 7 *d.* give 36562 *Feet*, 5 *Inch.* what will 7 *s.* 2 *d.* give? It gives 19298 *Feet*, 79 *Inch.* which divided by 33 is 584 *Tuns* [illegible], or 16 *C.* 20 *lib.* the Weight of the Ship at her light Mark-line or Draught of Water.

Then × 107 by 34, 'tis 3638, which × by 17, 'tis 61846. Divided by 94, 'tis 657 *Tuns*, 18 *C.* 60 *lib.* the Tunnage, according to Custom.

	Tuns.	C.	qr.	lib.
The Weight of the Ship at her Launching is	584	16	0	20
The Weight of Utensils and Managers	90	1	1	4
Total	674	17	1	24
The Weight of the Ship at her deep Mark	1102	5	0	0
Which subtracted, remains for the Lading	427	7	2	4
The Tunnage as customary	657	18	2	4
Difference	230	11	0	0

By

By which it appears, that such a Ship doth not properly carry her Tunnage according to what she is rated at, by above 200 Tuns; so that instead of making use of 94 for a Divisor, it ought to be 144.

		Feet.	Inch.
Draught of Water light	Afore	9	6
	Aft	11	9

Fig. I. shews the Figure of a Fifth-Rate, carrying 44 Guns.

	Feet.	In.
Length on the Lower Gun-deck	106	0
Length on the Keel to cast the Tunnage	89	0
Breadth from Out to Out, for D°.	29	0
Depth in Hold	10	6

Fitting two Parallelopipedon Pieces between the Lines *a. d. b. e.* and *b. e. c. f.* I measure and weigh them.

		c.	d.		c.	d.
Weight of the	Upper Piece, *a. d. b. e.*	5	9	together	10	6
	Lower Piece, *b. e. c. f.*	4	9			

		Feet.	Inch.		Feet.
Measure of the upper Piece.	Length	104	9	Area	18226 : [illegible]
	Breadth	29	0		
	Depth	6	0		
Measure of the lower Piece.	Length	100	3	Area	14335 : [illegible]
	Breadth	26	0		
	Depth	5	6		
				Total	32562 : 25

The

The upper Piece fashion'd off

The lower Piece D°

Together —— 6 : 6

		Feet.	Inch.
Deep Draught of Water —	Aft ——	12	10
	Afore ——	11	10

Then if 10 *s.* 6 *d.* give 32562 *Feet*, 25 *Inch.* what will 6 *s.* 6 *d.* give? *Answ.* 20157 *Feet*, 58 *Inch.* which divided by 33, is 610 *Tuns*, or 16 *C.* 3 *qr.* 5 *lib.* the Weight of the Ship at her deep Mark-line.

I proceed to shew the Weight at her Launching, and therefore fit a Parallelopipedon Piece of the same Length and Breadth at the Line *O. P.* which I measure and weigh.

Weight rough 6 *s.* 11 *d.* Fashion'd off 3 *s.* 8 *d.*

		Feet.	Inch.		Feet.	Inch.
The Measure is,	Length ——	101	3			
	Breadth ——	27	0	Area ——	20503	12
	Depth ——	7	6			

Then if 6 *s.* 11 *d.* gives 20503 *Feet*, 12 *Inch.* what shall 3 *s.* 8 *d.* give? And it gives 10859 *Feet*, 82 *Inch.* which divided by 33, is 329 Tuns, or 1 *C.* 2 *qr.* 11 *lib.* the Weight of the Ship at her light Mark-line, or Draught of Water.

Then × 89 by 29, 'tis 2581, which × by 14½, is 37424½, and ÷ by 94, is 398 Tuns, $\frac{13}{188}$, or 2 *C.* 2 *qr.* 4 *lib.* the Tunnage according to Custom.

	Tuns.	C.	qr.	lib.
The Weight of the Ship at her Launching is —	329	10	2	11
The Weight of Utensils and Managers —	60	7	2	0
Total ——	389	9	0	11
The Weight of the Ship at her deep Mark —	610	16	3	5
Which subtracted, remains for the Lading —	221	7	2	22
The Tunnage as customary ——	398	2	2	4
Difference ——	176	14	3	10

From which it may be observed, that such a Ship doth not properly carry her Tunnage according to what she is rated for, by almost

almost 200 Tuns. Therefore instead of making use of 94 for a Divisor, it ought to be 169.

		Feet.		Inch.
Draught of Water light	Afore	6	:	9
	Aft	10	:	[illegible]

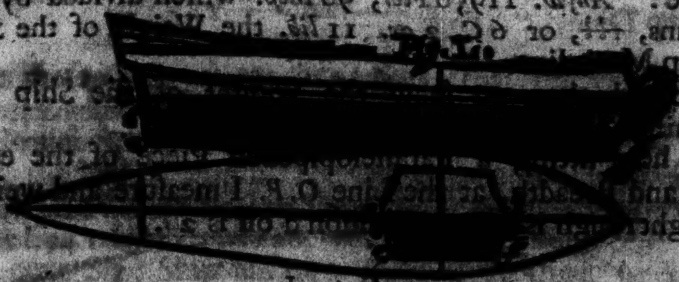


Fig. L. shews the Figure of a Sixth Rate, carrying 24 Guns.

	Feet.		In.
Length on the Main-deck	96	:	4
Length of the Keel to cast the Tunnage	80	:	0
Breadth from out to out for D.	24	:	6
Depth in Hold	10	:	1

And fitting two Parallelopipedon Pieces between the Lines *a.d. b.c.* and *b.c. e.f.* I weigh and measure them.

Weight of the	Upper Piece *a.d. b.c.*	[illegible]	:	[illegible]	together is [illegible]
	Lower Piece *b.c. e.f.*	2	:	6	
		Feet.		*Inch.*	

						Feet.	
Measure of the upper Piece.	Length	91	:	6	Area	10088	: [illegible]
	Breadth	24	:	6			
	Depth	4	:	6			
Measure of the lower Piece.	Length	88	:	6	Area	8761	: [illegible]
	Breadth	22	:	0			
	Depth	4	:	6			
						18849	: 37

The upper Piece fashion'd off	2	:	6
The lower Piece fashion'd off	1	:	3
	3	:	9

		Feet.	In.
Deep Draught of Water	Aft	10	6
	Afore	10	0

Then if 5 s. 11 d. give 18849 *Feet*, 37 *Inch.* what shall 3 s. 9 d. give? *Answ.* 11956 *Feet*, 96 *Inch.* which divided by 33, is 362 Tuns, $\frac{33}{100}$, or 6 C. 2 *qr.* 11 *lib.* the Weight of the Ship at her deep Mark-line.

I pro[illegible] then to [illegible] the Weight of the Ship at her Launchin[illegible]

And he[illegible] a Parallelopipedon Piece of the extream Length and Breadth, at the Line *O. P.* I measure and weigh it.

Weight [illegible] is 2 s.

		Feet.	In.		Feet.	Inch.
The Measure.	Length	89	0	Area	11258	5
	Breadth	23	0			
	Depth	5	6			

Then if 4 s. give 11258 $\frac{1}{100}$, what shall 2 s. give? And it gives 5629 $\frac{1}{100}$, which divided by 33, is 170 Tuns, $\frac{1}{100}$, or 11 C. 3 *qr.* the Weight at her light Mark-line, or time of Launching.

Then × 80 by 24-6, it makes 1960-0, which × by 12-3, is 24010-0, and ‖ by 94, is 255 Tuns $\frac{42}{100}$, or 8 C. 1 *qr.* 12 *lib.* the Tunnage according to Custom.

	Tuns.	C.	qr.	lib.
The Weight of the Ship at her Launching is	170	11	3	0
The Weight of Utensils and Managers	36	4	0	20
Total	206	15	3	0
The Weight of the Ship at her deep Mark	362	6	2	11
Which subtracted leaves for the Lading	155	10	3	11
The Tunnage as customary	255	8	1	12
Difference	099	17	2	1

From which it may be observed, that such a Ship doth not properly carry her Tunnage according to what she is rated for, by near 100 Tuns. Therefore instead of making use of 94 for a Divisor, it ought be 155.

		Feet.	Inch.
Draught of Water light	Afore	5	1
	Aft	7	6

From these Observations it appears, that the very Basis of Ship-building is false, and the Tunnage erroneous, from which all our Proportions, Dimensions and Scantlings are raised. For,

First, the largest Ship of 100 Guns, doth not carry her Tunnage in this Position by 441 Tuns, or $\frac{4}{13}$ Parts, and the Divisor instead of 94 ought to be 128, which is 34 Difference.

The next Size Ship has 357 Tuns Difference, or $\frac{1}{4}$ Part is left out, and the Divisor instead of 94 is 125, or 31 Difference.

But perhaps it may here be asked, why the Divisors are not alike, but rather less in this Ship than the other? To which I answer, that a Second Rate Ship ought to be something fuller than a First Rate, since the former having but 45 Foot Breadth, has near as much Accommodation required as the latter, and therefore should be somewhat blunter bodied.

The Third Size has 294 Tuns Difference, or $\frac{1}{11}$ Parts are left out of her Tunnage, and the Divisor is 130, which is 36 Difference.

The Fourth Size has 230 Tuns Difference, or $\frac{2}{17}$ Parts left out of her Tunnage or Lading, and the Divisor is 144, which is 50 Difference. And hence the Difference appears between full and sharp Ships, since the Divisors between this Ship and the biggest by this Method is 16.

The Fifth Size has 176 Tuns Difference, and $\frac{4}{9}$ Parts are left out of her Lading, and the Divisor is 169, which is 75 Difference.

The Sixth siz'd Ship has 99 Tuns Difference, and $\frac{2}{11}$ Parts left out, the Divisor being 155, which is 61 Difference.

And here again it may be asked, why the Excess in the Divisors is not as much between the Fifth and Sixth Rate, as between the Fourth and Fifth? To which I answer, that the Fifth Rate is an unsizeable Ship, and much heavier in proportion than the Sixth Rate, and therefore she sinks in her natural Position much

more than the other; and for the advantage of carrying her Ports open on occasion, she has not the Liberty of being fill'd, or weighted, to make her deep Load-mark equal to her light Markline.

And this Maxim will be found to hold with more Exactness, if we proceed to perfect the Building and Equipping of this Noble Machine.

AN

AN
ESSAY
For Proportioning the
RIGGING.

HAving bissected the Hull, or Body of a Ship, and briefly shewn the Five principal things which ought to be consider'd in putting such a Machine together; I shall now treat, with as much Brevity as possible, how she is to be made fit for her respective Uses. And this, as may be observed by the following Account, has been mightily improved by the practical Part, with very little Help from the Theory. For 'tis not many Years since Bow-lines and Braces have been introduced to bow, brace or bend the Sails, and put them in a capacity of traversing the Ship, or to carry her to Windward, as 'tis term'd; but Ships were obliged either to go directly to Leeward, or just as the Force of the Wind drove them.

I shall not at present inquire into the Original or Antiquity of Sailing: That 'tis very antient, appears from all History, as well Sacred as Human. It shall therefore suffice here to shew how much the Art of Navigation has been improv'd by Practice.

The Center of the Masts Places is general in all 3 Mast Ships. Wherefore having laid down two Figures of Ships by direct Dimensions, and fitted a Scale for them, the Centers of the Masts for all other Ships may from thence be found. For as the Proportion any Ships Length is to these, so are the Centers of the Masts Place one to another, and may be set off from the Stem or Stern-post upon either the Gun-deck, or deep Load Markline.

Having described the Place of each Mast's standing, I shall in the next place shew how the Length and Bigness of every Mast is found, tho' from a Custom so very different, that 'tis almost impossible to make it general.

Main-mast.

The Main-mast is the first Mover, whose Proportion is always found from some part of the Ship, either Length, Breadth, Depth, or Bulk of the Body, and from thence the Dimensions of all the other Masts and Yards are taken.

But to shew a little the different Methods made use of in this matter; some will have it, that the Breadth and Depth of the Ship being added together, and multiplied by 3, and divided by 5, will give the Length of the Main-mast in Yards. Others again will take in the Length of the Keel for a Member to find the Proportion of this Mast; which cannot be methodical, since two Ships may be of equal Length upwards, or equal in Bulk, and their Keels differ 10 Foot.

Now 'tis my Opinion, that the Length at the Lower Gun-deck ought to be one principal Part in this case, because it is to be very near the Place of Bearing, and where the Body is divided between two Elements. 'Tis also near the Place where the Sails are managed; for the Yards, if not the Mast, ought to be longer or shorter, according to the Ship's Length at that Seat. The extream Breadth of the Ship ought to be another part, since the broader any Ship is, the more she will resist the Medium, and the more Sail will be requisite to drive her. The Depth should also be taken in, being almost of the same Nature as the Breadth.

To apply this therefore, I take the Length of the Gun-deck, the main Breadth, and Depth in Hold, and add them together, and take the Half for the Length of the Main-mast in Feet, only subtracting the Depth of the Main-step out of the Depth in Hold, which Depth of the Main-step I allow to be $\frac{1}{7}$ of the Depth in Hold.

Length

	Feet	In.
Length on the Lower Gun-deck from the Inside of the Rabbets ——	150	0
Breadth from the Outside of the Plank ——	40	0
Depth in Hold 16-16 : 0 Take out 2 Feet, 8 In. remains	13	4

$$6)\,16\,(2\text{-}8 \qquad 2:8 \qquad 3)\,101\text{-}8\,(\,\overset{Feet}{33} : \overset{In.}{10\tfrac{1}{2}} \qquad 203 : 4$$
$$\quad 4 \qquad\quad 13 : 4 \qquad\quad 12 \qquad\qquad\qquad 101 : 8$$

Length of this Ship's Main-mast in Yards is 33 Yards, 10 Inches $\frac{1}{2}$.

The Length of the Main-mast being considered, the next thing requisite is to make her Diameter in the biggest place suitable to it, or the Stress it will bear. Which Proportion is also various, not only from the Bulk and Uneasiness of the Ship, but also from the Difference there is in the Strength of the Timber, and Nature of the Soil from which it is produced.

Let us suppose then three sorts of Trees, one of *Riga*, another of *Gottenburgh*, and a third of *New England*. A Mast of 9 Inches Diameter of *Gottenburgh* Growth would be equal to one of 10 Inches and half of *Riga* Growth, and those two of such a Bigness will be equal to a *New England* Tree of 12 Inches Diameter. Not but that there may be a vast Difference between the Trees of each Country's Growth, not only from the Years they have stood, but also from the Soil where they grew.

It must be observed, that for every Yard in Length of a Main-mast for a Ship of the largest Size, there is an Inch allowed for the Diameter; for a middle-siz'd Ship $\frac{7}{8}$ or $\frac{6}{7}$ of an Inch; and for a small one $\frac{4}{5}$ or $\frac{3}{4}$ of an Inch. And this is also in some measure to be allowed according to the Security the said Masts have by the Rigging.

FORE-MAST, TOP-MASTS.

The Fore-mast ought to be [illegible] or [illegible] of the Main-mast, the Fore-top-mast [illegible] of the Fore-mast; and so the Main-top-mast to the Main mast.

MAIN-YARD, FORE-YARD, TOP-SAIL-YARDS, &c.

The Main-yard is [illegible] of the Main-mast, the Fore-yard [illegible] of the Main-yard, Top-sail Yards [illegible] of the Main-yards respectively, the Top-

Top-gallant Yards $\frac{2}{3}$ the Top-sail Yards, and the Top-gallant masts $\frac{1}{2}$ of the Top-masts, or something shorter.

Bowsprit, &c.

The Bowsprit should be $\frac{2}{3}$ of the Main-mast for Length, or $\frac{3}{4}$ of the Foremast for small Ships; and for Bigness, let it be $\frac{9}{10}$, or more, of the Main-mast. The Sprit-sail Top-mast is $\frac{1}{2}$ of the Fore-top-mast for Length, allowing $\frac{3}{4}$ of an Inch in Diameter to every Yard in Length for the smallest of these Masts or Yards, and not exceeding one Inch for the biggest.

Mizon-mast.

The Mizon-mast ought to be (in such a Ship as the Figure represents) $\frac{2}{3}$ of the Main-mast, allowing $\frac{3}{4}$ of an Inch Diameter for every Yard in Length. And this Length for the Mizon-mast is when it steps in the Hold, but if upon the Lower Gundeck, then the $\frac{2}{3}$ of the Main-mast will be sufficient. But in a small Ship $\frac{1}{2}$ of the Length of the Main-mast will do for the Mizon-mast, if it steps in the Hold.

Mizon-top-mast.

The Mizon-top-mast is $\frac{1}{2}$ of the Mizon-mast stept in Hold, allowing $\frac{3}{4}$ of an Inch for Bigness to a Yard in Length.

Mizon-yard, &c.

The Mizon-yard is as long as the Fore-yard, allowing $\frac{1}{2}$ an Inch in Bigness for a Yard in Length; Mizon-top-sail Yard $\frac{1}{2}$ of the Mizon-yard, allowing $\frac{1}{2}$ of an Inch for Bigness. The Cross-jack Yard is something longer than the Main-top-sail Yard, allowing to every Yard in length $\frac{1}{2}$ Inch in Diameter. The Sprit-sail Yard is $\frac{2}{3}$ of the Fore-yard, and Sprit-sail Top-sail Yard $\frac{1}{2}$ the Sprit-sail Yard.

It was the Opinion of a very good Mast-maker, to take the Length of the Lower Gundeck, and the extream Breadth, and adding them together, to take $\frac{2}{5}$ that for the Length of the Main-mast in Feet, *viz.*

Length

Length on the Deck, from Rabbet to Rabbet 150
Breadth extream —————————— 40

$$\begin{array}{r} 190 \\ 3)\ 95 \\ 2 \end{array}\left(\begin{array}{cc} Yds. & Ft. \\ 31 & : 2 \end{array}\right.$$

This Mast, according to Custom, is 32 Yards.

Therefore between this Calculation and the aforesaid, may every three-masted Ship's Main-mast be proportion'd.

Having briefly describ'd the Dimensions of the Masts and Yards proper for any Ship, I shall proceed to shew what Rigging is necessary to secure them, and Engines to perform the Services requisite to be done on board the Ship, as also the Pulleys of a lesser Denomination to traverse the Sails, and bend them to the Wind.

In order to this, I might divide the Rigging into Three Parts, for a better Explanation of it, but shall content my self with making two Figures to shew every Rope with as much Clearness as possible, and shall also so interchangeably place the Rigging in each Figure, that what is upon one Mast and not upon the other, must be suppos'd to be wanting on the Mast, to make the Rigging compleatly perfect, which is done, that the Sight of one part of the Rigging may not hinder or embarass that of the other.

In the triple Division above-mentioned, the first part being the Grand Engines, as Pendants of the Tackles, Runners, and Tackle-falls fitted with Blocks and Shivers for facilitating the Purchace, serves to regulate many other Parts, as the Yards, Topmasts, Anchors, Boats, all sorts of Stores and Provisions, and also to set taught the Standing Rigging.

The Second Part is the Stays, Shrowds, and Back-stays, the grand Security of the Masts, for which reason they ought to be as near as possible placed in a circular Position, that the Security may equally affect the Strain.

The Third Part is to the smaller Pulleys, made use of to trim the Sails to the Wind, which Ropes ought to be placed with as much Advantage to the Purchace as possible, that the Angle the Rope makes at the Pulley may be as obtuse as possible, and that they may come one clear of another, and be brought down or convey'd from Pulley to Pulley to the Decks of the Ship, where they

may

may be conveniently haled and fasten'd, which is term'd belay'd.

But I shall proceed to shew in the Figures how all this may be performed with as much Clearness as possible.

Figure A.

A. is the Main, Mean, or Middle Mast.
B. the Fore-mast.
C. the Bowsprit.
D. the Sprit-sail Yard.
E. the Sprit-sail Top-sail Yard.
F. the Sprit-sail Top-mast.
G. the Jack-staff.
H. the Fore-yard.
I. Fore-top-sail Yard.
K. the Fore-top-mast.
L. Fore-top-gallant Yard.
M. Fore-top-gallant Mast.
N. Fore-top-gallant Stump.
O. the Main Yard.
P. the Main-top-sail Yard.
Q. the Main-top Mast.
R. Main-top-gallant Yard.
S. Main-top-gallant Mast.
T. Main-top-gallant Stump.
U. the Mizon Mast.
W. the Mizon Yard.
X. Cross-jack Yard.
Y. Mizon-top-sail Yard.
Z. Mizon-top Mast.
1. Mizon Flag-staff.
2. the Ancient Staff.

Go towards the Bowsprit.

RIGGING.

3. Sprit-sail Top-sail Lifts.
4. Sprit-sail Trusse-trees and Cross-trees.
5. Fore-top-gallant Stay.
6. A Crane-line, as a Back-stay for the Sprit-sail Top-mast.
7. the Fore-top-mast Stay.
8. Sprit-sail Lifts.
9. the Sprit-sail Braces.
10. A Bob-stay to steddy the Bow-sprit against the Strain of the Fore-stay.
11. the Gammoning of the Bowsprit, being fasten'd to the Knee of the Head, and the grand Security the Bowsprit hath.
12. the Ship's Cable, as if at an Anchor.
13. the Fore-stay.
14. Fore-lifts to keep the Yard horizontal, or directly level each way.
15. the Fore-top-sail Lifts.
16. Fore-top-gallant Lifts.
17. the Fore-runner, and the single Part above it is the Pendant of the Fore-runner and Tackle, the first Piece of Rigging that's placed over the Mast.
b 1. the Fore-tackle Fall.
18. the Pendant of the Fore-top-mast Tackle.
g 1. the Fore-top-tackle Fall.

f. i. the Block.
19. the Main-stay.
20. the Guy of the winding Tackle.
21. the Guy of the Garnet.
22. the Garnet-fall, a Tackle much in use to hoist in all the Stores and Provisions.
23. the Winding Tackle Fall, which is put up on purpose to get the Guns in and out.
24. the Main Lifts.
25. Main-top-sail Lifts. The Top-sail Lifts are used as Top-gallant Sheets.
26. the Main-top-gallant Lifts.
27. the Main-top-mast Shrowds.
28. The Main Shrowds, and the Cross-lines, called Ratlins, serving as Steps to go into the Main-top.
29. The main Swifter a Part of the Shrowds, but not ratlin'd.
30. The Mizon Stay.
31. Mizon Top-sail Sheets.
32. Cross-jack Lifts.
33. Mizon Top-sail Lifts.
34. Mizon-Top-mast Stay.
c i. the Boat-rope made fast to the Boat to tow her a-stern.
d i. the Guess-rope, which is also made fast to the Boat to keep her directly in the Wake of the Ship.

Go back to the Main-mast.

b. the Lanyards of the Main Shrowds reev'd through dead Eyes of Wood, the lower of which are Iron-bound, called Chain-plates.
36. the Puttock Shrowds binding the main Shrowds and Top-mast Shrowds together.
37. The Main Top.
38. The Main Cap.
39. The Main Trusle-trees and Cross-trees. Observe that every lower Mast has a Round Top for the Conveniency of furling the Top-sail, and spreading the Shrowds. Also the Bowsprit in this Size has a Top, and all bigger sized Ships, but none less. Likewise all Masts have Trusle-trees, Cross-trees, and Caps, being to scarph the Masts one to another.

Go forward to the Foremast.

L. i. the Sheet Anchor.
k. i. the best Bower Anchor hung up with the Shank-painter Chain at one End, and the Cat-block at the other. Which Cat is the part that hales the Anchor out of the Water, when the Capstern can heave it no farther, the Cable being bended to this Anchor, and going into the Hawse-hole.
41. the Fore Jeers that hoist the Yard up.
40. the Sprit-sail, Top-sail Braces.
35. A Crow-foot at the Mizon Peek, as much for Ornament,

as to keep the Mizen Yard at a constant Angle.

42. Horses for the Yards; a Conveniency for Men to tread on, in going out to furl the Sails.

43. The Main and Fore Top-sail Sheets.

I come now to the second Figure, in which I shall set down the Running Rigging, without taking notice of the Masts, Yards, and Standing Rigging, which I shall refer to the former Section and Index. Note also, that I have not drawn the Yards to their extream Lengths in this Figure, for the more clearly shewing the Sails.

Figure B.

A. is the Fore-sail. The upper Part is called the Head of the Sail, the Extreams of which are the Ears, made fast to the Yard with Lines called Ear-rings. The lower Part *c.* is called the Foot of the Sail, the Extremes of which *b.* is called the Clew, where the Sheets and Tacks are made fast, hal'd up with Ropes called Garnets.

27. Clew-garnets. Observe that in haling up this Sail, the Clew-lines are the First-movers, haling up not only the Weight of the Sail, but the Sheets, and Tacks, and Blocks belonging thereto.

e. is the Leach of the Sail, where are Ropes on the other side, called Leech-lines, 26.

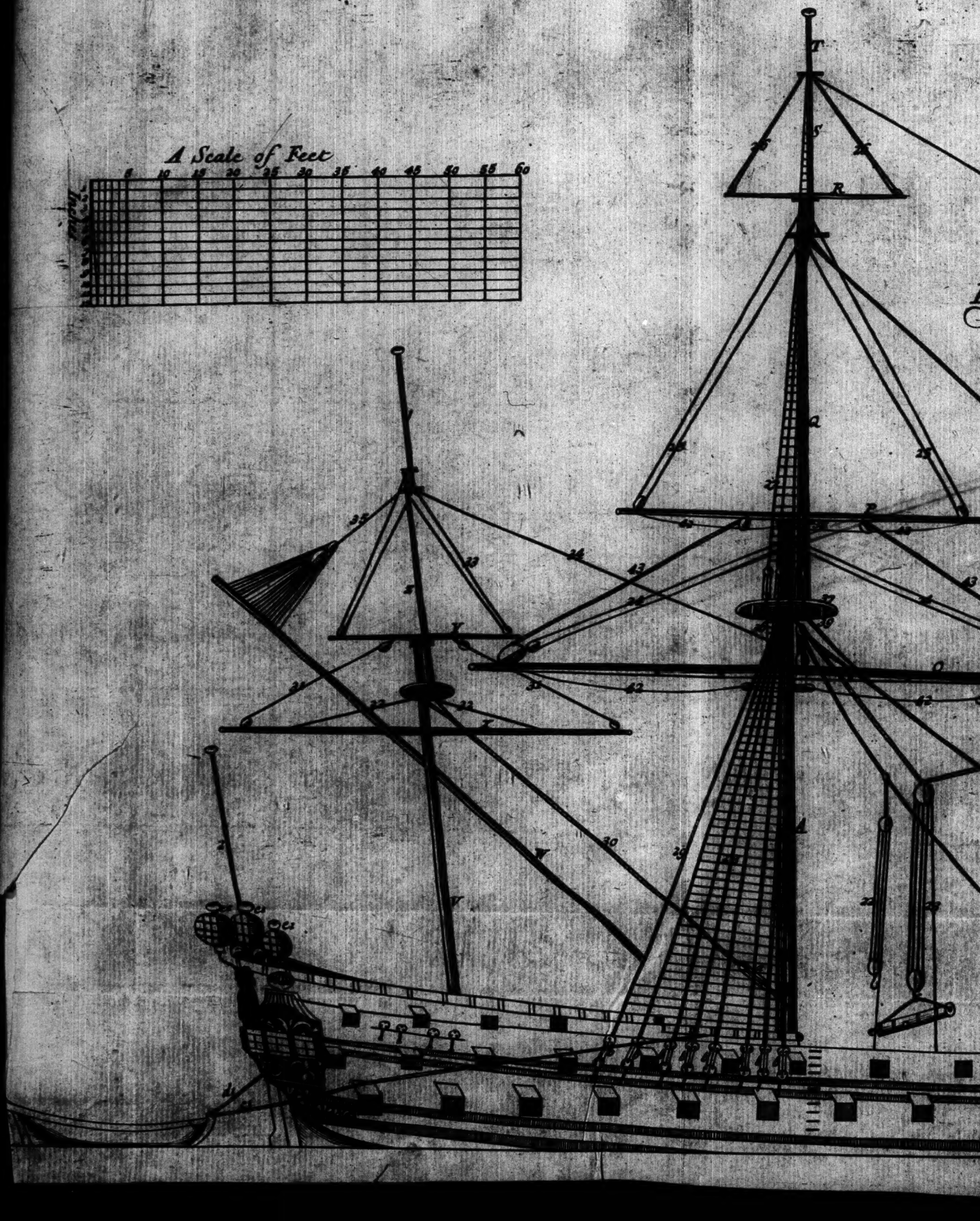
The Middle part, or Body of the Sail is termed the Bunt, from its swelling out, and the Ropes that hale it are called Bunt-lines, 25.

a. i. are the Bow-lines, opposite to which are the Braces *b. i.* which two Ropes trim the Sail, and set it to the Wind.

29. The Pendants of the Braces.

2. The Fore-sheets, and 3. the Fore-tacks, which two Ropes set the lower part of the Sail, as the Braces do the upper part, and Bow-lines the middle part. This Sail is tack'd down to the Head of the Ship, if there be any; otherwise there is a Piece fitted for that purpose, as a Prow, by some called a Bumpkin.

And


A Scale of Feet
Inches

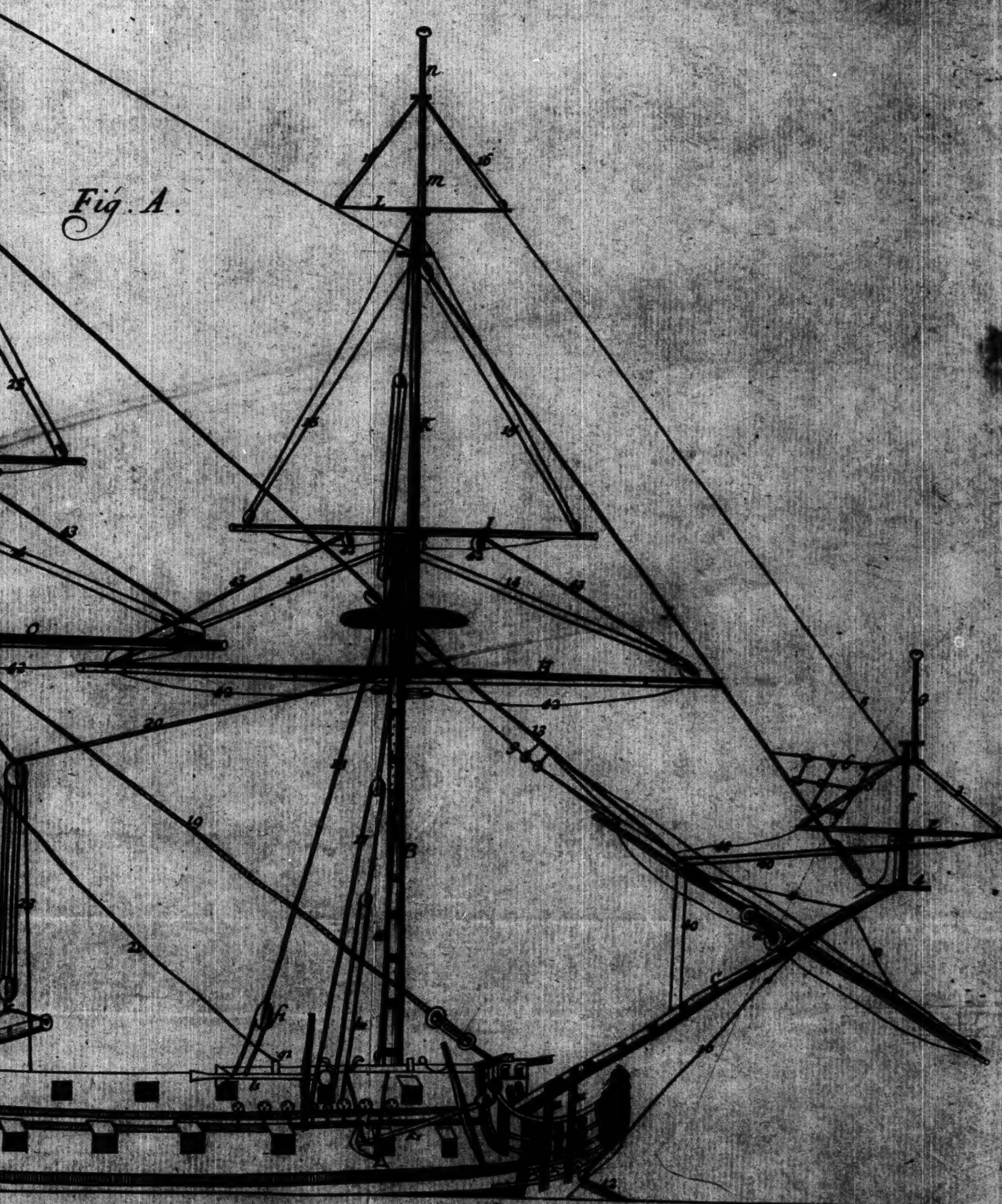
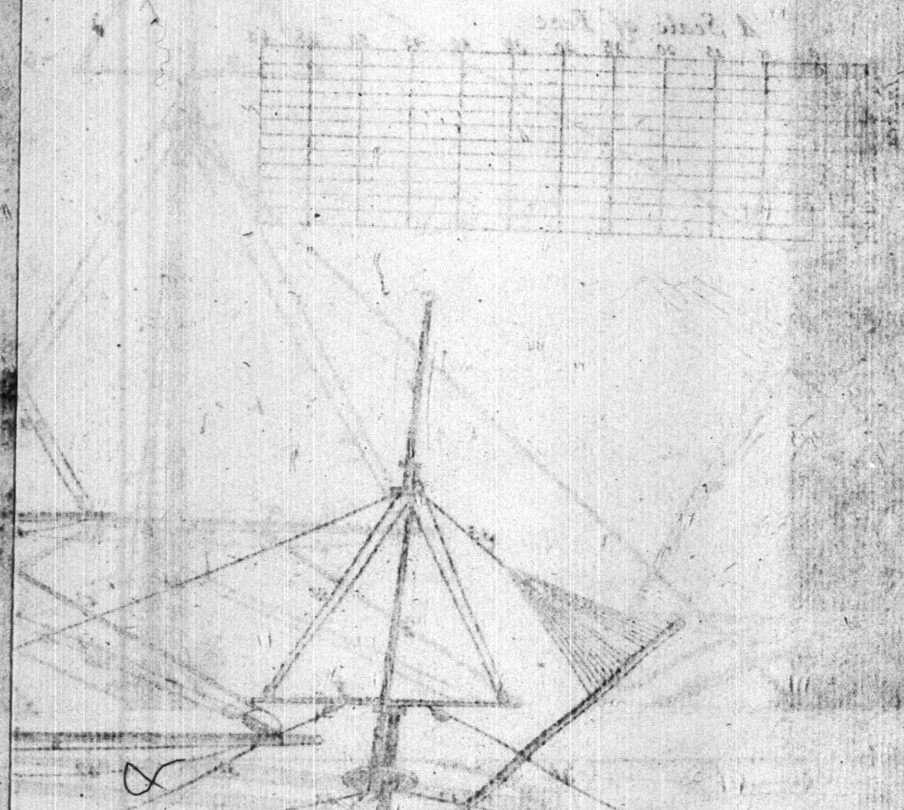


Fig. A.



And this may suffice to describe the Sails, since the Parts of all Square Sails are called by the same Names.

B. is the Fore-top-sail braced back, which is done either in traversing or tacking the Ship, or otherwise to stop her way, term'd Lying-by.

a. and *b.* are Reeves to take up part of the Sail as the Wind rises, and it becomes dangerous either for the Sides of the Ship, or the Masts to carry the Top-sail a-trip; and if it should be lower'd without being reef'd, it will not stand sharp to the Wind, but bag, and be opposed to the Motion of the Ship. And since these Sails taper, and the upper part is no squarer than the Top-sail Yard, and the lower part fited to the Main-yards; it should be observed in allowing for the Yard-arm, that the Top-sail Yard be so much longer than the general Allowance, as the Difference is between the Length of the Sail at the Head, or upper part, and the Length at the lower Reef *b.* and that Allowance should be put into the Yard-arm without the Cleats, for the Conveniency of Reefing the Sail. These Yard-arms may be without the Cleat, for every Inch the Yard is in Diameter in the middle part, or Slings, 2 Inches in Length.

The lower part of all Top-sails are spread by the Main-yards, there being Blocks provided for that purpose, call'd Top-sail-sheet Blocks 30. the Top-sail Sheets being reev'd there, and brought through another Block near the Slings of the Yard, and so handed down to the Decks, where they are reev'd through Knight-heads, and so hall'd home, and belay'd about the Knight-heads, or Top-sail-sheet Bits.

5. Fore-top-sail Braces. 31. Fore-top-sail Bunt-lines.
4. Fore-top-sail Bowlines. 32. Fore-top-sail Leech-lines.

It may be also observed, that the Extremes of every Sail are bound with a Rope called a Bolt-rope.

C. is the Fore-top-gallant Sail. *d.* are the Sheets of the Fore-top-gallant Sail, and Fore-top-sail Lifts.

This Sail imitates a Signal for spying an Enemy, when they lay the Top-gallant Sheets are flown.

6. the Fore-top-gallant Bow-lines.

7. the Braces.

Observe that every Rope is convey'd down to the Deck from one Stay to another, and so to the Masts, and there perpendicularly

lower'd, having Conveniencies provided in the Hull of the Ship both to hale and belay every Rope.

E. is the Main-sail, neither furl'd, set, nor spread; but, as 'tis often term'd, hal'd up in the Brails, in order either to furl or to shorten the Sails.

10. Main Braces.
11. Bow-lines.
12. Main-tack.
32. Main Sheets.
33. Main Bunt-lines.
34. Leech-lines.

G. is the Main-top-sail set to the Wind.

8. Main-top Bow-lines.
9. Braces.
36. Bunt-lines.
37. Leech-lines.
45. Clew-lines.

H. Main-top-gallant Sail.
15. Main-top-gallant Braces.
14. D° Bow-lines.
46. Clew-lines.

I. the Mizon hal'd up in the Brails.

19. are the Main Brails.

20. the Peek Brails. Observe that the upper End of the Mizon is call'd the Mizon-peek; and when a Mizon is reef'd, 'tis called a Mizon Ballast.

10. the Mizon Sheet.
47. Mizon Bowlines.
48. Mizon Tack.

K. the Mizon-top-sail, where may be observ'd a Reef, not much out of Necessity, as to practice Youth.

16. Mizon-top-sail Braces.
17. Cross-jack Braces.
18. Mizon-top-sail Bow-lines.
49. Clew-lines.
21. Poop Lanthorns to carry Lights.

Go to the Main-mast.

22. the Swifter.
25. a Breast Back-stay.
35. a Crow-foot to save the Top-sail, when 'tis handed or taken in.
23. Top-sail Hall-yard Runner.
24. Hall-yard Fall, or Hall-yard.

Go to the Fore-mast.

37. the Back-stays.
38. a Messenger to keep the Top-sail Hall-yard clear of the Fore-top.

Go to the Bowsprit.

D. the Sprit-sail furl'd.
L. the Sprit-sail Top-sail furl'd.

The Lines that are drawn cross the Yards are call'd Rope-bands; they make fast the Sail to the Yard, and Gaskets furl them.

There

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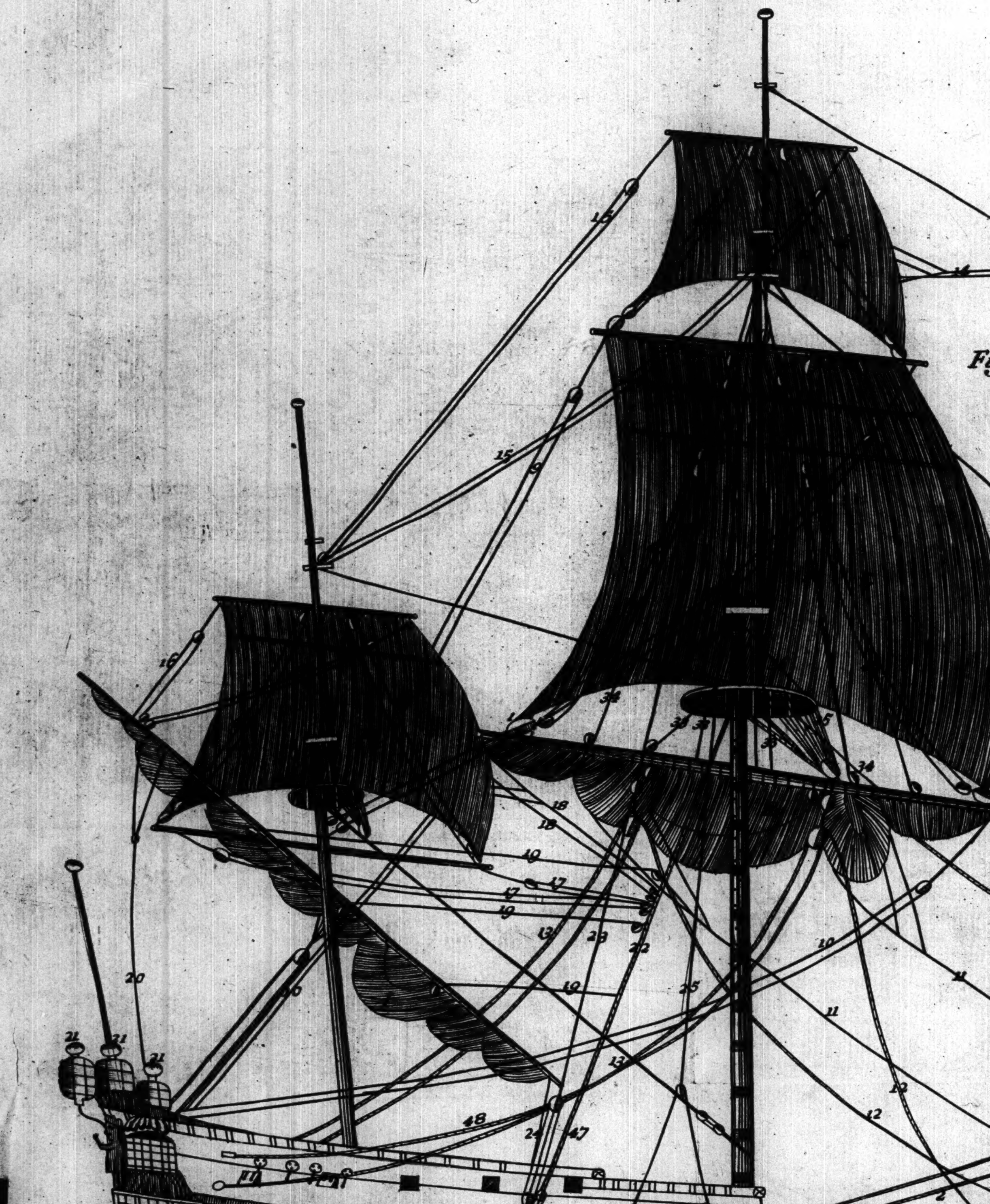
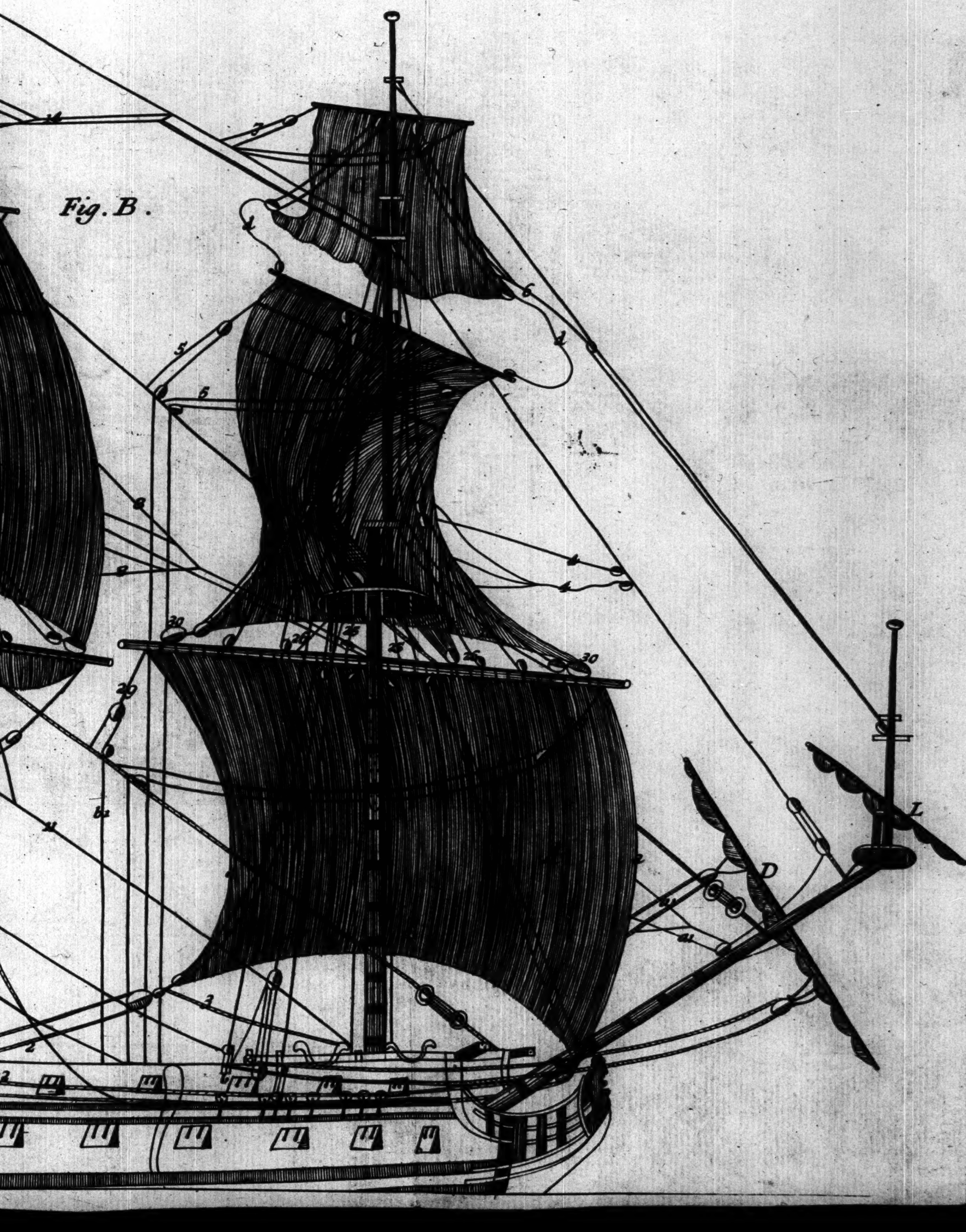


Fig. B.



There are other Sails called Stay-sails used on almost every Stay; as, the Main Stay-sail, Main-top-mast Stay-sail, Fore-top-mast Stay-sail, Mizon Stay-sail, and sometimes on the Mizon-top-mast Stay, and Top-gallant Stay. And such Sails are very useful, if the Ship goes any thing from the Wind, that is, when the Sails are constantly full, and not shivering.

There is another Sail call'd a flying Gib, a Sail of good service to draw the Ship forward, but very prejudicial to the Wear of the Ship forward.

'Tis used with a Boom or small Mast extended at the Extremes of the Bowsprit.

There are also Sails call'd Studding Sails, made use of at the Extremes of the Main Yards and Top-sail Yards, very beneficial when the Ship goes before the Wind or Quartering, otherwise they are useless.

I am of opinion, that the Length of the greatest part of any Ship's Rigging cannot well be exprest with more Exactness than in the Figures here annex'd. And as for those other Parts whose proper Lengths don't appear in this single View, as Stays, Shrowds, *&c.* a little Assistance from able and experienc'd Boatswains and Riggers will be able to compleat these Figures, and make them universal for giving the exact Length of every Piece of Rigging in any Ship. And the Charge of such Figures will be very inconsiderable to the Rope that may be saved in making them.

But I shall now proceed to give the customary Allowance for Rigging a Three-mast Ship, and then draw a general Proportion for Rigging any other Ship of Three Masts.

The Proportion of the RIGGING of a SHIP of near Six Hundred Tuns, according to the Customary Allowance; with the Sizes of the Blocks, and also the Rigging for the Loug-boat and Pinnace; with the other Utensils proper to compleat the Rigging; from whence the Rigging of all other Three-Mast Ships may be known.

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.* Circumference.	Length.	*Blocks.* Species.	Size in Inch.	Number.	Shivers, Ash, or Lignum vitæ.
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Bowsprit.						
Horses for the Bowsprit	3	8	*Dd. eye.*	8	14	
Lanyard	$1\frac{1}{2}$	3				
Straps for Horses						
Gammoning } *Bowsprit*	$5\frac{1}{2}$	60		46	2	
Woolding } *Bowsprit*	$2\frac{1}{2}$	65				
Bob-stay, worn		6				
Lanyard						
Sheats Cabl'd	3	60	*Round.*	11	2	
Pendants Cabl'd						
Tye						
Hallyards	3	18	*L. Ta.*	23	1	*L.*
			Single.	13	1	*A.*

NAMES OF THE *Standing and Running* RIGGING.	Ropes. *Circumference.*	*Length.*	Blocks. *Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Bowsprit.						
Lifts	3	38	*Single.*	9	6	*A.*
Standing Lifts	3½	6	*Dd. eye.*	7	4	
Lanyards	1¾	5				
Braces	2	58	*Single.*	9	10	*A.*
Pendants	2½	3				
Slings	4½	4				
Seizing and Racking	1	4				
Horses for the Yard, worn	3	6	*Dd. eye.*	8	14	
Lanyards	1	6				
Clew-lines	2½	32	*Single.*	9	6	*A.*
Bunt-lines	2½	22	*Long.*	10	1	*A.*
Reef-lines	1	36				
Flying Gib Hallyards	3	40				
Sheets	2½	26				
Jack	3	16				
Sprit-Sail Top-Mast.						
Shrowds	2	14	*Dd. eye.*	5	8	
Lanyards	1	8				
Pendants } of *Back-stays*	2	3 }	*Single.*	6	10	*A.*
Falls } of *Back-stays*	1	18 }				
Tie	2	2½				
Hallyards	1½	7	*Single.*	7	2	*A.*
Lifts	1½	14	*Single.*	6	4	*A.*
Braces	1	30	*Single.*	6	4	*A.*
Pendants	1½	3				
Parrel-ropes	1½	1½	*Parrell.*	10	1	
Clew-lines	1½	36	*Single.*	6	6	*A.*
Rope-bands and Earings						
Gaskets						

NAMES OF THE Standing and Running RIGGING.	Ropes. Circumference.	Length.	NAMES OF THE RIGGING. Blocks. Species.	Size in Inch.	Number.	Shivers, Ash, or Lignum-vitae.
	Inch.	Fath.		Inch.		A. or L.
Fore-Mast.						
Pendants of Tackles, fine	6½	6	Single.	16	2	L.
Runners of Tackles	5½	24	L. Tack	28	2	L.
Falls of Tackles	3½	56	Single.	16	2	L.
Shrowds, fine	6½	110	Dd. eye.	12	12	Elm.
Lanyards	3½	42				
Railing	1¼	200				
Worming	¾	450				
Cat-harpings { Leggs, Falls }	1½	20	Single.	8	12	A.
Stay Cabl'd, fine	10	11	Dd. eye.	16	1	Elm.
Lanyard	2½	8				
Worming	1½	54				
Coller Cabl'd	9	2½	Dd. eye.	16	1	Elm.
Woolding, Puddening } the Mast	2½	95				
Crow-feet for the Top	1	20	Sing.	6	2	A.
Tackle for Ditto	1	3				
Jeers	5½	70	Double.	18	3	L.
Lashers { to Mast-head	1					
Lashers { to the Yard	3	21				
Lashers { for Blocks	1					
Tackles for Boats { Pendants, Falls }	2½	28	Single.	10	2	A.
Lifts	3½	50	Single.	11	4	L.
Straps for the Cap	3	2½				
Straps for Blocks						
Braces	3½	48	Single.	9	4	A.
Pendants	3½	5				
Parrel-ropes	4	12	Parrel.	24	1	
Nave-line	1½	20	Single.	6	2	A.

NAMES OF THE *Standing and Running* RIGGING.	Ropes. Circumference.	Ropes. Length.	Blocks. Species.	Blocks. Size in Inch.	Blocks. Number.	Shivers, Ash, or Lignum vitæ.
	Inch.	Fath.		Inch.		A. or L.
Fore-Mast.						
Racking and Seizing	1	16				
Horses for the Yard, worn	$4\frac{1}{2}$	10	Dd. eye.	8	14	Elm.
Lanyards	2	5				
Puddening the Yard, worn	5	8				
Sheet Cabl'd	5	60	Single.	17	2	L.
Stoppers worn	5	3				
Lanyards	$\frac{3}{4}$	2				
Tacks Taper and Cabl'd	6	28				
Luff-hook ropes	5	7				
Bow-lines	3	42	Single.	12	2	A.
Lashers for Blocks	$2\frac{1}{2}$	6				
Bridles	3	4				
Clew-garnets	3	48	Should.	10	8	L.
Bunt-lines	2	70	Long.	16	2	A.
			Single.	8	8	A.
Leech-lines { *Legs* / *Fall* }	$2\frac{1}{2}$	36	Single.	8	6	A.
Reef-lines	1	46				
Ear-rings						
Rope-bands and Ear-rings	$1\frac{1}{2}$	80				
Gaskets						
Fore-Top-Mast.						
Shrowds, fine	4	58	Dd. eye.	8	8	Elm.
Lanyard	$2\frac{1}{2}$	26				
Ratling	$\frac{3}{4}$	40				
Pendant } *of the Top-Rope*	6	11	Single.	16	12	L. Iron-
Fall } *of the Top-Rope*	$3\frac{1}{2}$	38	Double.	15	2	bound.
Pendants } *of Burton Tackles*	3	5	Single	9	4	A.
Fall } *of Burton Tackles*	2	34				

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.* Circumference.	Length.	*Blocks.* Species.	Size in Inch.	Number.	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Fore Top-mast.						
Puttock Shrowds	$3\frac{1}{2}$	24	*Dd. eye.*	8	8	
Standing Back-stays, fine	4	58	*Dd. eye.*	8	4	
Lanyard	2	12				
Stay	$4\frac{1}{2}$	14	1 *Tac.*	18	1	*A.*
			Single	12	1	*A.*
Lanyards	$2\frac{1}{2}$	8				
Runner, fine	$4\frac{1}{2}$	16	*Single.*	14	2	*L.*
Hallyards	$2\frac{1}{2}$	36	*Single*	20	1	*L.*
				18	1	
Lifts	$2\frac{1}{2}$	56	*Single.*	9	4	*L.*
Beckets about the Cap	$2\frac{1}{2}$	$1\frac{1}{2}$				
Slings, worn	$3\frac{1}{2}$	9				
Parrel-ropes	3	6	*Parrel*	18	1	
Racking	$1\frac{3}{4}$	7				
Horses for the Yard, worn	3	6	*Dd. eye.*	7	4	
Sheet, fine	5	42	*Should.*	17	4	*L.*
Span, worn	2	2				
Lashers for { *Quar.* / *Sheet* } *Blocks*	$1\frac{3}{4}$	4				
Bow-lines	2	36	*Single*	8	2	*A.*
			Treble	9	1	*A.*
Bridles	2	10				
Clew-lines	$2\frac{1}{2}$	66	*Single.*	9	4	
Bunt-lines	2	32	*Long.*	14	1	
			Single	8	2	*A.*
Reef-tackle { *Tye*	$2\frac{1}{2}$	5	*Single.*	8	4	*A.*
Reef-tackle { *Fall*	$1\frac{1}{2}$	12				
Leech-lines	2	12	*Single.*	7	4	
Braces	$2\frac{1}{2}$	50	*Single*	8	6	*A.*
Pendants	$2\frac{1}{2}$	3				

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.* Circumference	Length	*Blocks.* Species	Size in Inch.	Number	Shivers, Ash, or Lignum vitæ
	Inch.	*Fath.*		*Inch.*		*A.* or *L.*
Fore-Top-mast.						
Stay-sail Stay, worn	$3\frac{1}{2}$	6	*Dd. eye.*	6	2	*Elm.*
Cringles, worn	$2\frac{1}{2}$	3				
Lanyards	1	3				
Hallyards	$1\frac{1}{2}$	16	*Single.*	9	2	
Sheet	$1\frac{1}{2}$	10				
Tack	2	2				
Reef-lines	$\frac{3}{4}$	36				
Ear-rings						
Rope-bands and Ear-rings	1	40				
Fore-Top-Gall-Mast.						
Shrowds	2	12	*Dd. eye.*	5	4	*Elm.*
Lanyards	1	10				
Puttock Shrowds	2	4	*Dd. eye.*	5	4	
Stay	$1\frac{1}{2}$	15	*Single.*	7	1	*A.*
Tye	2	$2\frac{1}{2}$	*Single.*	6	3	*A.*
Hallyards	$1\frac{1}{2}$	24				
Lifts	1	16	*Single.*	6	4	*A.*
Braces	1	46	*Single.*	6	8	*A.*
Pendants	1	4				
Parrel-ropes	1	2	*Parrel.*	9	1	
Bow-lines	1	34	*Single.*	6	6	*A.*
Bridles	1	8				
Clew-lines	$1\frac{1}{2}$	46	*Single.*	6	4	*A.*
Main-mast.						
Pendants of Tackles	$6\frac{1}{2}$	7	*Single.*	17	2	*L.*
Runners of Tackles	6	24	*L. Tack.*	28	2	*L.*
Falls of Tackles	$3\frac{1}{2}$	56	*Single.*	18	2	*L.*
Pendant of the Garnet	5	11	*L. Tack.*	30	1	*L.*

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.* Circumference	*Ropes.* Length	*Blocks.* Species	*Blocks.* Size in Inch.	*Blocks.* Number	*Blocks.* Shivers, Ash, or Lignum vitæ.
	Inch.	Fath.		Inch.		A. or L.
Main-mast.						
Guy of the *Garnet*	4	8	*Single.*	18	1	*L.*
Fall of the *Garnet*	$3\frac{1}{2}$	28	*Snatch.*	26	1	*L.*
Shrowds, fine	$6\frac{1}{2}$	142	*Dd. eye.*	13	14	*Elm.*
Lanyards	$3\frac{1}{2}$	50				
Ratling	$1\frac{1}{2}$	210				
Worming	1	700				
Cat-harpings { *Leggs*, *Falls* }	2	24	*Single.*	8	14	*A.*
Stay Cabl'd 4 *Strands, fine*	12	16	*Dd. eye.*	18	1	*Elm.*
Lanyard	$4\frac{1}{2}$	10				
Lasher to Fore-Mast	$2\frac{1}{2}$	6				
Worming	2	80				
Coller Cabl'd	$9\frac{1}{2}$	7	*Dd. eye.*	18	1	*Elm.*
Woolding the Mast	$2\frac{1}{2}$	130				
Crow-feet for the Top	1	24	*Single.*	10	1	*A.*
Tackle for Ditto	1	3	*Single.*	6	1	*A.*
Jeers, fine	$5\frac{1}{2}$	80	*Double.*	20	3	*L.*
Lashers { *to Mast-head*, *to the Yard*, *for Blocks* }	3	23				
Tackles for Boats { *Pendants*, *Fall* }	$2\frac{1}{2}$	28	*Single.*	10	2	*A.*
Lifts	$3\frac{1}{2}$	58	*Single.*	11	4	*L.*
Straps for the Cap	3	4				
Braces	3	60	*Single.*	9	4	*A.*
Pendants	3	5				
Parrel-ropes	4	12	*Parrel.*	27	1	
Nave-line	$1\frac{1}{2}$	24	*Single.*	8	2	*A.*
Racking and Seizing	1	18				
Horses for the Yard, worn	$4\frac{1}{2}$	12	*Dd. eye.*	9	4	*Elm.*

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.*		*Blocks.*			
	Circumference.	*Length.*	*Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Main-Mast.						
Lanyards	$2\frac{1}{2}$	4				
Puddening the Yard, worn	$5\frac{1}{4}$	10				
Sheet Cabl'd	6	64	*Single.*	18	2	*L.*
Stoppers	$\frac{3}{4}$	3				
Lanyards		2				
Tacks Taper and Cabl'd	$6\frac{1}{2}$	30				
Luff-tackles	3	26	*L. Tac.*	18	2	*A.*
			Single.	11	2	*A.*
Bow-lines	$3\frac{1}{2}$	36	*Snatch.*	24	1	*L.*
Bridles	3	10				
Tackle	$2\frac{1}{2}$	10	*Single.*	10	2	*A.*
Clew-garnets	$2\frac{1}{2}$	50	*Should.*	10	6	*L.*
Bunt-lines	2	75	*Long.*	18	2	*A.*
			Single.	8	8	*A.*
Leech-lines *Pendants*						
Leech-lines *Leggs*	2	38	*Single.*	9	4	*A.*
Leech-lines *Falls*						
Stay-sail Stay, worn	4	11	*Dd. eye.*	8	2	*Elm.*
Lanyards	2	3				
Cringles, worn	$2\frac{1}{2}$	3				
Hallyards	2	20	*Single.*	8	1	*A.*
Sheet	$2\frac{1}{2}$	4				
Tack	3	2				
Studding-sail Hallyards	3	46	*Single.*	10	4	*A.*
Sheet	$2\frac{1}{2}$	12				
Tack	3	24				
Reef-lines	$1\frac{1}{2}$	60				
Rope-bands and Ear-rings	$1\frac{1}{2}$	90				
Gaskets						

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.* Circumference	*Ropes.* Length	*Blocks.* Species	*Blocks.* Sheave in Inch.	*Blocks.* Number	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Main Top-Mast.						
Shrowds	$4\frac{1}{2}$	64	*Dd. eye.*	9	8	
Lanyards	$2\frac{1}{2}$	26				
Ratling	1	60				
Pendant } *of the Top-Rope*	6	13	*Single.*	18	1	*Iron-bd.*
Fall } *of the Top-Rope*	4	40	*Double.*	16	2	*L.*
Pendants } *of Burton Tackles*	$3\frac{1}{2}$	6				
Fall } *of Burton Tackles*	2	36	*Single.*	10	6	*A.*
Puttock Shrowds	4	26	*Dd. eye.*	9	8	*Elm.*
Standing Back-stays, fine	$4\frac{1}{2}$	66	*Dd. eye.*	8	6	*Elm.*
Lanyards	$2\frac{1}{2}$	12				
Stay Cabl'd, 4 *Strands, fine*	$4\frac{1}{2}$	19	*L. Tac.*	20	1	*L.*
			Single.	14	1	*A.*
			Double.	12	1	*A.*
Tye						
Runner	5	18	*Single.*	15	2	*L.*
Hallyards	3	45	*Single.*	21	1	*L.*
			D°.	19	1	*L.*
Lifts	$2\frac{1}{2}$	58	*Single.*	9	4	*A.*
Beckets about the Cap	$2\frac{1}{2}$	2				
Braces	$2\frac{1}{2}$	54	*Single.*	9	4	*A.*
Pendants	$2\frac{1}{2}$	5				
Beckets ab. Miz. Mast.	3	2				
Slings, worn	3	9				
Parrel-ropes	3	7	*Parrel.*	20	1	
Racking	$\frac{3}{4}$	9				
Horses for the Yard, worn	$2\frac{1}{2}$	7	*Dd. eye.*	8	4	
Sheet	$5\frac{1}{2}$	46	*Should.*	18	4	*L.*
Span, worn	$2\frac{1}{2}$	3				
Lashers for { *Quar. Sheet* } *Blocks*	$\frac{3}{4}$	4				

NAMES OF THE *Standing and Running* RIGGING.	Ropes.		Blocks.			
	Circumference	*Length.*	*Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Main Top-Mast.						
Bow-lines	3	42	*Single.*	10	2	*A.*
Bridles	3	16				
Clew-lines	3	70	*Single.*	10	6	*A.*
Bunt-lines	2	34	*Long.*	18	2	*A.*
			Single.	9	2	
Leech-lines	2	14	*Single.*	8	2	*A.*
Reef-Tackle Tye	$2\frac{1}{2}$	5	*Single.*	10	4	*A.*
Fall	$1\frac{1}{2}$	16				
Stay-sail Stay, worn	$2\frac{1}{2}$	8	*Dd. eye.*	6	2	
Lanyards	$1\frac{1}{2}$	3				
Cringles, worn	2	3				
Hallyards	$1\frac{1}{2}$	18	*Single.*	8	2	*A.*
Sheet	$1\frac{1}{2}$	15	*Single.*	6	1	*A.*
Tack	2	1				
Studding-sail Hallyards	$2\frac{1}{2}$	40	*Single.*	10	4	*A.*
Sheet	2	6				
Tack	2	10				
Reef-lines	1	36				
Ear-rings						
Rope-bands and Ear-rings	1	56				
Main Top Gall. Mast.						
Shrowds	$2\frac{1}{2}$	14	*Dd. eye.*	6	4	*Elm.*
Lanyards	1	10				
Puttock-shrowds	$2\frac{1}{2}$	5	*Dd. eye.*	6	4	
Stay	$1\frac{1}{2}$	18	*Single.*	6	4	*A.*
Tie	$2\frac{1}{2}$	3				
Hall-yards	$1\frac{1}{2}$	28	*Single.*	7	2	*A.*
Lifts	$1\frac{1}{2}$	16	*Single.*	6	6	*A.*
Braces	1	48	*Single.*	6	6	*A.*

NAMES OF THE *Standing and Running* RIGGING.	Ropes. *Circumference*	Ropes. *Length.*	Blocks. *Species.*	Blocks. *Size in Inch.*	Blocks. *Number.*	*Shivers, Ash, or Lignum-vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Main Top Gall. Mast.						
Pendants	1	4½				
Parrel-ropes	1	2	*Parrel.*	10	1	
Bow-lines	1½	48	*Single.*	6	6	*A.*
Bridles	1	4				
Clew-lines	1½	54	*Single.*	7	4	*A.*
Mizon-Mast.						
Shrowds, fine	4½	64	*Dd. eye.*	9	8	Elm.
Lanyards	2½	24				
Ratling	1	70				
Pendants } of *Burton-tackle*	3½	5	*Single.*	10	6	*A.*
Falls } of *Burton-tackle*	2½	36				
Straps for Blocks						
Stay Cabl'd, 4 *Strand fine*	4½	12	*Dd. eye.*	9	2	Elm.
Lanyards	2½	3½				
Coller	4	2				
Crow-feet for the Top	¾	12	*Single.*	4	2	*A.*
Tackle for Ditto	¾	3				
Jeer, fine	4	30	*Double.*	15	1	L.
			Single.	15	1	L.
Lashers { *at Mast-head* / *on the Yard* / *for Blocks* }	2½	6				
Parrel-ropes	2½	4	*Parrel.*	21	1	
Truss	2	18	*L.Tack.*	16	1	*A.*
			Single.	9	1	*A.*
Slings	4½	8	*Single.*	13	2	*A.*
Sheet	3½	18				
Tack	2½	3				
Bow-lines	2½	8	*Single.*	9	2	*A.*

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.*		*Blocks.*			
	Circumference.	*Length.*	*Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Mizon-Mast.						
Peek-brails	1					
Middle Brails	2	90	*Single.*	8	12	*A.*
Main Brails						
Lacing the Mizon	1	34				
Stay-sail Hallyards	2	18	*Single.*	8	1	*A.*
Sheet	2½	4				
Tack	2	3				
Cross Jack-Yard.						
Standing-Lifts	2½	6	*Dd. eye.*	5	4	*Elm.*
Lanyards	1½	4				
Braces	1½	36	*Single.*	8	6	*A.*
Pendants	2	2½				
Slings	3½	4	*Single.*	12	1	*A.*
Mizon Top-mast.						
Shrowds	2½	24	*Dd. eye.*	5	6	*Elm.*
Lanyards	1	10				
Puttock Shrowds	1½	10	*Dd. eye.*	5	6	*Elm.*
Stay	2½	8	*Single.*	8	9	*A.*
Lanyards	1	6				
Tye	2½	3½	*L. Tack.*	15	1	*A.*
Hallyards	2	18	*Single.*	9	1	*A.*
Straps for Blocks						
Lifts	1½	20	*Single.*	7	4	*A.*
Braces	1½	34	*Single.*	7	4	*A.*
Pendants	1½	2½				
Parrel-ropes	1½	2	*Parrel.*	11	1	
Sheets	2½	32	*Single.*	9	4	*A.*
Bow-lines	1	32	*Single.*	9	4	*A.*

NAMES OF THE *Standing and Running* RIGGING.	Ropes.		Blocks.			
	Circumference	*Length.*	*Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Mizon-Top-mast.						
Bridles	1					
Clew-lines	1½	32	*Single.*	7	4	*A.*
Necessary Ropes.						
Vyol Cabl'd	10	30	*Single.*	43	1	*L.*
Straps for Ditto	7	6				
Lashers for Ditto	3	12				
Lashers for Blocks						
Seizings for Blocks						
Straps for Blocks	7½	7				
Pendant of *Winding-tackle*	8	11	*Treble.*	22	1	*L.*
Fall of *Winding-tackle*	5	35	*Double.*	22	1	*L.*
			Snatch.	20	1	*L.*
Pendant of the *Fish-tackle*	6½	7	*L. Tack.*	28	1	*L.*
Fall of the *Fish-tackle*	3½	28	*Single.*	16	1	*L.*
Straps ab. Main-mast						
Lanyards	2	5				
Cat-ropes	4½	40	*Double.*	16	2	*L. Iron-bound.*
Lanyards	2	7				
Stoppers-sheet						
Bower-best	5½	21				
small						
Shank-Painters Sheet						
Bower-best	5½	15				
small						
Stoppers at Bitts	8	12				
	7½	4				
Seizings	¾	40				
Lanyards	3	23				

NAMES OF THE *Standing and Running* RIGGING.	Ropes.		Blocks.			
	Circumference	*Length.*	*Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Necessary Ropes.						
Buoy-ropes Cabl'd *Sheet*, *Bower-best*, *small*	6½	60				
Preventers	7½	6				
	5½	18				
	4	4				
	3½	12				
Lanyards	1	8				
	¾	64				
Buoy-slings	3½	30				
Slings Gun	7	6				
Butt	6	9				
Hogshead	4	8				
Nutt	3	2				
Horses in the Head, worn	3½	8	*Dd. eye.*	9	4	*Elm.*
Lanyards	1½	5				
Ladder for the Poop, worn	4	18				
Middle-rope	1½	14				
Lasher	1	8				
Puttock-staves, worn	4½	7				
Cable-bends	2½	30				
Ropes-Bell, worn	2	2				
Cann-hook	3	2½				
Davit	—	—	*Single.*	19	1	*L.*
Entring	3	12	*Seizing.*			
Port	2½	52	*Single.*	11	12	*L.*
	2	50		10	11	*L.*
Slip	—	—	—	9	7	*L.*
Stancheon Waste, worn	2	56		6	10	*L.*
Tiller	3	3				

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.*		*Blocks.*			
	Circumference	*Length.*	*Species.*	*Size in Inch.*	*Number.*	*Shivers, Ash, or Lignum vitæ.*
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Neceſſary Ropes.						
Waſte, worn	$4\frac{1}{2}$	14				
Lanyards	2	6				
Salvages for Shrowds, worn	$3\frac{1}{2}$	3				
Puddening of Anchors	$2\frac{1}{2}$	60				
Seizings	[illegible]	50				

An Abſtract of Iron-work.

Tackle Hooks	30	*Number.*
Puttock-Hooks	24	
Fiſh	1	
Puttock-plates	24	
Staples	24	
Thimbles large	34	
Ordinary	118	

NAMES OF THE Standing and Running RIGGING	Ropes. Circumference	Length	Blocks. Species	Size in Inch.	Number	Shivers, Ash, or Lignum vitæ.
	Inch.	Fath.		Inch.		A. or L.
Long-Boat.						
Pendants } of *Burtons*	3	2				
Falls } of *Burtons*	2	16				
Fore-sheets	1	2				
Hallyards	1	7				
Main-stay	2½	4				
Tye	2½	3	*Single.*	7	2	*A.*
Hallyards	1½	7	*Single.*	4	2	*A.*
Sheet	2	5				
Tack	2	1				
Boat-rope Cabl'd	6½	25				
Guest-rope Cabl'd } *Grapnel-rope* Cabl'd	3½	30				
Painter	3	5				
Yard-rope	¾	9				
Pinnace.						
Fore-sheet	1	2				
Main-sheet	1					
Boat-rope Cabl'd	4	30				
Guess-rope Cabl'd	3½	26				
Painter	2½	4				

NAMES OF THE *Standing and Running* RIGGING.	*Ropes.* Circumference	*Ropes.* Length	*Blocks.* Species	*Blocks.* Size in Inch.	*Blocks.* Number	*Blocks.* Shivers, Ash, or Lignum vitæ.
	Inch.	*Fath.*		*Inch.*		*A. or L.*
Skiffe.						
Fore-sheet						
Main-sheet						
Hanks						
Swifter						
Grapnel-rope						
Painter						
Stern-fast						
Fenders						
Lanyards						
Rother-rope						

The whole Allowance for Seizings and Strapping of Blocks.

	Inch.	Fath.
Strapping for all the Blocks	6	40
	$5\frac{1}{2}$	20
	5	30
	$4\frac{1}{2}$	40
	4	40
	$3\frac{1}{2}$	40
	3	40
	$2\frac{1}{2}$	50
	2	50
	$1\frac{1}{2}$	40
All Seizings	2	30
	$1\frac{1}{2}$	20
	1	216
	$\frac{3}{4}$	216

Other Stores for fitting the Rigging.

Spun Yarn	20 Hundred Weight.
Lines Tarr'd	60 Number.
White	2 Ditto.
Marline Tarr'd	46 } Pound.
White	3 }
Old Canvas	170 Yards.
Tarr	2½ Barrels.
Rozin } for Masts & Blocks	60 } Pound.
Tallow }	100 }
Oyle } for the Yards and Heads of Masts	4 Gallons.
Blacking }	8 Barrels.
Woolding Nails	1480 Number.
Old Leather Buckets	5 Ditto.
Twine	5 Pound.
Trenails	22 Number.
Double Laglines	4 } Number.
Trucks for Shrouds	42
Booms	8
Stumps	3
Rains	3
Tarr Brushes	2
Blacking	2
Ballast Baskets	2
Wood Basket	2
Candles	2 Pounds.
Brooms	12 Number.
Junk for Fenders	2 Hundred Weight.

The Number and Nature of the Blocks taken by themſelves for the more convenient Receiving and Providing them.

Species.	Size.	Number.	Aſh or Lignum-vitæ Shivers.
	In.		
Dead Eyes.	5	32	
	6	12	
	7	8	
	8	44	
	9	30	
	12	12	
	13	14	
	16	2	
	18	2	
Single Blocks.	6	100	
	7	35	A.
	8	100	
	9	75	
	10	44	
	11	18	
	12	4	
	13	3	
	14	3	
	15	3	
	16	5	
	17	6	
	18	7	
	19	2	
	20	1	L.
	21	1	

Species.	Size.	Number.	Aſh or Lignum-vitæ Shivers.
	In.		
Snatch Blocks.	20	1	
	24	1	
	26	1	
Long headed	46	2	A.
Round	11	2	L.
Strap'd board Blocks.	8	6	A.
	10	22	
Shoulder'd Blocks	17	2	L.
	18	2	
Long Tackle Blocks.	15		
	16	1	A.
	18	1	
	20	1	
	23	1	
	24	2	L.
	28	6	
	30	1	
Treble Blocks.	9	1	A.
	22	1	L.
Double Blocks.	15	1	
	18	3	L.
	20	3	
Large Buntline Blocks.	14	1	
	16	3	A.
	18	2	

Species.	Size.	Number.	Ash, or Lignum vitæ Shivers.	Species.	Size.	Number.	Ash, or Lignum vitæ Shivers.
Parrels.	9	1	—	Cat-blocks double Iron-bound.	16	2	L.
	10	2	—				
	11	1	—				
	18	1	—	Top-block Iron-bound single.	16	1	
	20	1	—		18	1	
	21	1	—				
	24	1	—	Top-tackle Blocks Iron-bound single.	15	2	L.
	27	1	—		16	2	
Long Crow-foot Blocks.	12	1	—				
	13	1	—	Viol Blocks.	43	1	L.
	14	1	—				

The Quality of Rope of every sort, and the Quantity in Fathoms.

Species.	Inches.	Fathoms.
Main Stay	12 —	16
	11 —	
Fore Stay and Viol	10 —	11 New. 30 Necessary Rope.
Main Stays Coller	9½ —	7
Fore Stays D°.	9 —	2½
Pendants and other necessary Ropes.	8 —	23
	7 —	11
	7 —	18
Main Shrowds, &c.	6½ —	243 New Rigging. 195 Necessary Rope.

Species.	Inches.	Fathoms.
Fore Shrowds.	6	256 New Do. 9 Necessary Rope.
Jeers Sheets and Runners, &c.	5½	210 New Do. 36 Necessary Rope.
	5	213 New. 8 Worn.
Top-mast Shrowds, Back Stays, &c.	4½	273 New. 22 Do. 40 Necess. 21 Do.
	4	294 New. 29 Do. 20 Necess.
	3½	331 New. 15 Do. 96 Necessary. 11 Do.
	3	917½ New. 21 Do. 61½ Necess.
Tackle Falls and the Running Rigging, &c.	2½	1158 New. 15 Worn. 149 Necess.
	2	842½ New. 5 Worn. 90 Necess. 7 Worn.
	1½	1107 New. 26 Necessary.
	1	681½ New. 29 Necessary.
	¾	569 New. 163 Necessary.

Total in Fathoms of all the New Rope for Rigging under 7 Inches, is 8095½ Fathoms.

The Proportion that 6 Inch. and ½ Rope bears to 6 Inches, is as 19 to 20.

6 In.	to 5½	is as 17 to 14.		3	to 2½	is as 4 to 5.
5½	to 5	is as 50 to 51.		2½	to 2	is as 11 to 8.
5	to 4½	is as 4 to 5.		2	to 1½	is as 13 to 17.
4½	to 4	is as 13 to 14.		1½	to 1	is as 2 to 3.
4	to 3½	is as 8 to 9.		1	to ¾	is as 3 to 1.
3½	to 3	is as 8 to 22.				

A General Proportion for the RIGGING *of a* THREE MAST SHIP.

For the BOWSPRIT.

HOrse's Length $\frac{4}{5}$ of the Bowsprit.

Circumference, $\frac{1}{7}$ of the Diameter of D°.

Dead Eyes for D°. twice the Diameter of the Circumference of the Horse.

Lanyard for D°. Length, $\frac{1}{2}$ of the Horse. Circumference, $\frac{3}{4}$ the Horse's.

Straps for D°. equal in Bigneſs to the Horse, and $\frac{2}{7}$ of the Length.

Gammonings, Circumference, $\frac{1}{3}$ of the Diameter of the Bowsprit, and 6 times its Length.

Wooldings, $\frac{1}{2}$ the Bigneſs of the Gammoning, and $\frac{1}{6}$ of the Length.

Bob-ſtay, $\frac{2}{3}$ of the Length of the Bowſprit.

Sheets for the Sprit-ſail Cabl'd, Circumference, $\frac{1}{7}$ of the Diameter of the Sprit-ſail Yard.

Length, 7 times as long as that Yard.

2 Round Blocks, 4 times the Length of the Circumference of the Sheet.

Pendants Cabl'd, $\frac{6}{7}$ of the Sheets for Bigneſs, and $\frac{1}{10}$ of the Length.

Hallyards, equal in Bigneſs to the Sheets, and $\frac{1}{2}$ the Length.

Lifts, equal in Bigneſs to the Pendants, and $\frac{2}{3}$ of the Length of the Sheets.

Seizing to the Bowſprit, $\frac{1}{2}$ of the Bigneſs of the Lifts, and $\frac{1}{5}$ of the Length.

Standing Lifts, equal in Bigneſs to the Horſes of the Bowſprit, and alſo in Length.

Lanyards, equal in Bigneſs to the Seizings, and half the Length.

Straps, $\frac{3}{4}$ of the Bigneſs of the Standing Lifts, and $\frac{1}{4}$ of the Length.

Braces, $\frac{5}{6}$ of the Lifts, and $\frac{1}{2}$ as much longer.

Pendants, $\frac{1}{3}$ bigger than the Braces, and $\frac{1}{10}$ of the Length.

Slings, twice as big in Circumference as the Braces, and $\frac{1}{15}$ of the Length.

Seizing and Rackings, $\frac{3}{10}$ of the Slings, and twice as long.

Horses for the Yards, Circumference [illegible] of the Diameter of the Yard, Length $\frac{5}{6}$ of the Yard.

Lanyards, $\frac{1}{2}$ of the Horses in Bigneſs, and $\frac{5}{6}$ of the Length.

Clew-lines, Circumference, $\frac{5}{21}$ of the Diameter of the Sprit-ſail Yard, and 4 times the Length of the Yard.

Bunt-lines, $\frac{4}{5}$ of the Clew-lines in Bigneſs, and $\frac{2}{3}$ of the Length.

Reef-lines, $\frac{1}{2}$ the Circumference of the Bunt-lines, and 5 times the Length of the Yard.

And after ſuch a Method may every individual Part of the Rigging be proportion'd and calculated. Tho' I cannot deny but it will be very troubleſome, and therefore I ſhall endeavour to abbreviate it, and make it ſomething eaſier. In the proſecution of which I ſhall obſerve this Method, only particularly to proportion the material Ropes, and bring all Lanyards, Pendants, Seizings, Straps for Blocks, Ratlings, Wormings, Runners of Tackles, and Tackle-falls, into a general Proportion as to their Bigneſs, ſhewing ſome Reaſons why it ſhould be ſo.

The Uſe of a Lanyard being to unite two other Parts together, as Stays and Shrowds, and ſeveral other Ropes that are very large, and cannot be ſo well joined or knit together, otherwiſe than by the help of ſmaller Ropes. I have obſerved it to be almoſt general, that the Lanyard is $\frac{1}{2}$ the Circumference of the Ropes they ſecure, ſo that they are $\frac{1}{4}$ as ſtrong; that 4 ſuch Parts are equal to one Part of the great Rope. Tho' it is uſual to have 6 Parts applied, as Lanyards to every Rope, that they ſo ſecure; and yet very often the Lanyard is broke, and very ſeldom the Shrowd. Which muſt certainly be owing to the moving of the Ship, when the Shrowds on one ſide being ſtretch'd by the Weight of the Maſt, the other Side gains Length, by which the Lanyards grow ſlack, and by a ſudden Jirk are fretted againſt the Wood in which they are reev'd, and ſo broke. For otherwiſe, in a regular Strain, the 6 Parts of the Lanyards of $\frac{1}{2}$ the Circumference of the Rope they ſecure, muſt hold longeſt.

Where-

Wherefore ſince 6 Parts of a Lanyard of ' the Circumference will be ſufficient to hold any ſuch Rope, there may be a general Proportion drawn, that where the Size of any Lanyard is required leſs in proportion to the Rope they ſo ſecure, as in Stays and ſeveral other Ropes, there the Number of Turns will make up the Lanyard equal in Strength to the 6 Parts of thoſe which are half the Circumference of the Rope. And for the Space between, allow for every Inch the Dead eye is in Diameter, 3 Inches and $\frac{1}{4}$ between each Dead eye. And this is for Thwart-ſhips, but Fore and Aft they need not be ſo much, but in a cubical Proportion between the Length and Breadth of the Ship. For the Property in this Part is no otherways to be conſider'd than from the Motion of the Ship, ſince the ſhorter the Space, the better for the Lanyard, but the worſe for the Great Rope.

The Seizings may be $\frac{1}{8}$ of the Rope they ſeize, allowing ſuch a Number of Turns, as may be equal to double the Weight of a Cube or Die-ſquare, made by each reſpective Rope ſo ſeiz'd.

Straps of Blocks are generally in two Parts, and ſometimes in four, which ought to be equal in Strength to the Folds of the Tackle-fall, or any other Rope. And ſince 4 Parts of any Rope of 6 Inches Circumference, are near equal to 2 Parts of a Rope alike in Goodneſs, of 8 Inches and $\frac{1}{2}$ in Circumference; thoſe two Parts will be ſuitable for a Strap to a Block that is uſed with 4 Folds, as a Tackle-fall, or any other running Rope. From whence may ariſe a general Proportion for ſtrapping every Block in a Ship, as to Bigneſs; but for the Length, they are practically allowed to be three times the Length of the Block, or ſomething more, it being altogether unreaſonable to confine the Workman or Rigger to an Inch of Rope. But it ought to be obſerved, that ſuch a Length will do, when the Block is only ſeized with an Eye; for if Blocks are to be put over a Yard, or the like, the Property will be alter'd.

Pendants; their Circumference may be conſidered from the preceding Rule of Strapping Blocks; but the Length is various according to their Uſe.

Ratlings are $\frac{1}{8}$ of the Shrowds: Wormings $\frac{1}{4}$ of the Rope.

Pendants of the Main and Foremaſt ought to be as big as the Shrowds, ſince they purchace a great Weight of Boats and Anchors.

The

The Runners are $1\frac{1}{2}$ of the Pendants, and Tackle-falls $\frac{1}{2}$ the Circumference of the Pendants.

But before I proceed any farther, I ſhall ſet down a few Abbreviations to contract a little the remaining Part, obſerving that all Rope is ſized as to its Bigneſs by the Circumference, which in every Article ſhall be firſt mention'd.

Cir. ——— *Circumference.*
Di. ——— *Diameter.*
Le. ——— *Length.*
D°. ——— *The ſame.*

For the SPRITSAIL TOP-MAST.

SHrowds, Cir. $\frac{2}{5}$ of the Di. of the Sprit-ſail Top-maſt in the Cap. Le. $\frac{2}{3}$ of the Top-maſt's Length.

Pendants of Back-ſtays, or Crane-line, as ſome call it, as big as the Shrowds, and $\frac{1}{5}$ of the Length.

Falls of the Pendants, $\frac{1}{2}$ the Pendant, and 6 times as long.

Tie of the Hallyards, as big as the Shrowds.

Hallyards, $\frac{1}{2}$ of the Tie, and 3 times as long as the Top-maſt. Le. of the Tie $\frac{1}{2}$ of the Hallyards.

Lifts, as big as the Hallyards, and twice as long.

Braces, $\frac{2}{3}$ of the Lifts, and twice as long.

Pendants of Braces, as big as the Lifts, and $\frac{1}{10}$ of the Le. of the Brace.

Parrel Rope, as big as the Pendants of the Brace, and for every Inch the Maſt is through in the Cap, allow 2 Feet for the Le. of the Parrel Rope.

Clew-lines, as big as the Lifts, and 5 times as long as the Hallyards.

For the FORE-MAST.

PEndants of Tackles, Cir. $\frac{2}{7}$ of the Di. of the Fore-Maſt in the Partners, and for every Inch in Circumference allow one Fathom for Length.

Runners of the Tackle, $1\frac{1}{2}$ of the Pendant, and 4 times the Length.

Tackle Falls, $\frac{1}{2}$ the Pendants, and 9 times the Length.

Shrowds

Shrowds, Cir. as big as the Pendants, and $\frac{8}{11}$ of the Le. of the Foremast.

Lanyards as before, Ratlings D°. Wormings D°.

Cat-harping Legs and Falls equal in Bigneſs, being $\frac{1}{4}$ of the Shrowds. Length twice that of the Fore-yard.

Fore Stays, Cir. $\frac{1}{2}$ the Di. of the Fore Maſt, and $\frac{8}{9}$ of the Length.

Lanyard, $\frac{1}{2}$ of the Stay, by reaſon this Lanyard's Strength is made up by the Number of Turns extraordinary.

It may alſo be obſerv'd, that the Le. of the Lanyard for the Stay, to the Le. of each Lanyard for the Shrowd, is as 2 to 1.

Worming as aforeſaid.

Collar of the Stay, $\frac{9}{10}$ in bigneſs to the Stay, and $\frac{1}{4}$ of the Length.

Woolding of the Maſt, for every Inch the Maſt is in Di. at the Partners, allow $\frac{1}{8}$ for the Cir. of the Woolding; and for the Le. allow 8 times the Le. of the Maſt.

Crow-feet for the Top, as big as the Ratling, and as long as the Cat-harpings. Tackle for D°. equal in Bigneſs, and $\frac{1}{7}$ of the Length.

Jeers, $\frac{1}{6}$ of the Shrowds, and 6 times the Le. of the Yard.

Laſhers for the Yards as big as the Lanyards of the Shrowds, and twice as long as the Stay.

Tackles for Boats, as big as the Woolding, and $\frac{1}{2}$ as long as the Falls of the Runner.

Lifts, $\frac{1}{2}$ the Shrowds for Bigneſs, and 4 times as long as the Fore Maſt.

Straps for the Cap, as big as the Lifts, and as long as the Collar of the Stay.

Braces, as big as the Lifts, and as long within the $\frac{3}{10}$ Parts.

Pendants, as big as the Braces, and $\frac{1}{10}$ as long. Which may be a general Rule for the Length of the Pendants of the Braces.

Parrel Rope, Cir. $\frac{1}{6}$ of the Di. of the Maſt in the Partners. And for every Inch the Maſt is there, allow 3 Feet for Length.

Nave-line, as big as the Cat-harpings, and as long.

Racking and Seizing for the Parrel, $\frac{2}{3}$ of the Nave-line, and $\frac{4}{5}$ of the Length.

Horſes for the Yard worn Rope, $\frac{9}{15}$ of the Jeers for Bigneſs, and $\frac{10}{11}$ of the Yard for Length.

Lanyards, ^{2} as big, and half as long.

Pudden-

Puddening for the Yard, as big as the Jeers, and 12 Cir. of the Yard in the Slings.

Fore Sheets, as big as the Jeers, and 5 times the Length of the Fore Mast.

Stoppers, as big as the Fore Sheets, and $\frac{1}{16}$ of the Length.

Lanyards, as big as the Worming of the Shrowds and $\frac{2}{3}$ of the Length of the Stoppers.

Fore Tacks, as big as the Sheets, but taper'd, and $\frac{5}{6}$ as long.

Bow-lines, as big as the Braces, and $\frac{7}{8}$ of the Length.

Lashers, $\frac{5}{8}$ of the Bow-lines, and $\frac{1}{7}$ of the Length.

Bow-line Bridles, as big as the Bow-lines, and $\frac{1}{10}$ of the Length.

Clew-garnets, as big as the Braces, and as long.

Bunt-lines, $\frac{2}{3}$ of the Clew-garnets, and as long as the Jeers.

Leech-lines, as big as the Bunt-lines, and half as long.

Reef-lines, $\frac{1}{2}$ the Leech-lines, and 4 times the Le. of the Yard.

Rope-bands and Ear-rings, $\frac{3}{4}$ of the Leech-lines, and 7 times as long as the Yard.

For the FORE TOP-MAST.

SHrowds, Cir. $\frac{1}{3}$ of the Di. of the Top-maſt, and $\frac{13}{14}$ of the Length.

Lanyards as aforeſaid, Ratlings D°.

Pendants of the Top-rope, as big as the Fore Shrowds, and as long as the Fore Yard.

Falls of the Top-rope $\frac{7}{12}$ of the Pendant, and 5 times as long as the Fore Top-maſt.

Pendants of Burton Tackles, Cir. $\frac{1}{4}$ of the Di. of the Top-maſt, and $\frac{2}{3}$ of the Length.

Burton-falls, $\frac{2}{3}$ of the Pendants, and 7 times the Length.

Puttock-ſhrowds, as big as the Top-rope Fall, and $\frac{2}{3}$ of the Length all together.

Standing Back-ſtay, as big as the Shrowds, and $\frac{9}{13}$ of the Le. of Foremaſt and Fore Top-maſt put together: Each of them Standing Back-ſtays.

Lanyards as aforeſaid.

Stays, Cir. $\frac{9}{11}$ of the Di. of the Fore Top-maſt, and as long as the Back-ſtays.

Lan-

Lanyards, as aforesaid.

Runner, as big as the Stay, and twice as long as the Fore Top-mast.

Top-sail Hallyards, $\frac{1}{2}$ of the Runner, and twice the Length, and $\frac{1}{2}$ the Length of the Top-mast more.

Lifts, as big as the Hallyards, and 4 times the Le. of the Stay.

Beckets upon the Cap, as big as the Lifts, and $\frac{1}{2}$ the Le. of the Pendants of the Burton.

Slings, worn Rope, as big as the Puttock-Shrowds, and 6 times as long as the Beckets.

Parrel Rope, Cir. $\frac{1}{4}$ of the Di. of the Top-mast in the Cap. And for Le. allow 3 Feet for every Inch the Top-mast is in the Cap.

Racking, $\frac{1}{4}$ of the Parrel Rope, and $\frac{1}{2}$ longer.

Horses for the Yard, worn Rope, as big as the Parrel Rope, and $1\frac{1}{8}$ of the Le. of the Yard for Length.

Topsail Sheets, Cir. $\frac{1}{3}$ of the Di. of the Fore Yard in the Slings, and twice the Le. of the Fore Yard each.

Span worn, $\frac{2}{3}$ of the Sheet, and $\frac{1}{7}$ of the Length.

Lashers, as big as the Racking, and $\frac{1}{3}$ as long as the Lanyard of the Stay.

Bow-lines, Cir. $\frac{2}{3}$ of the Fore Bow-lines, and as long as the Top-sail Hallyards.

Bridles, as big as the Bow-lines, and $\frac{2}{7}$ of the Length.

Clew-lines, as big as the Top-sail Hallyards, and 8 times the Le. of the Fore Top-mast, and $\frac{1}{2}$ its Length.

Bunt-lines, as big as the Bow-lines, and $\frac{1}{2}$ as long as the Clew-lines.

Reef-tackle { Tye, as big as the Clew-lines, and $\frac{1}{2}$ as long as the Bow-line Bridles.
Fall, $\frac{1}{2}$ of the Tye, and $\frac{1}{2}$ of the Le. of the Bow-lines. }

Leech-lines, as big as the Bunt-lines, and as long as the Reef-tackle Fall.

Braces, as big as the Clew-lines, and $\frac{3}{4}$ of the Length.

Pendants of Braces as big as the Braces, and $\frac{1}{10}$ of the Length.

Stay-sail Stay, worn, $\frac{7}{9}$ of the Stay, and $\frac{1}{4}$ of the Length.

Cringles worn, as big as the Lanyards, and $\frac{1}{3}$ the Le. of the False Stay together.

Lanyards, $\frac{1}{4}$ of the Stay, and $\frac{1}{3}$ the Length.

U Hall-

Hallyards, as big as the Reef-tackle Fall, and 3 times the Le. of the Stay.

Sheet, as big as the Hallyards, and $\frac{2}{3}$ of the Length.

Tack, $\frac{1}{4}$ bigger than the Sheets, and $\frac{1}{3}$ of the Length.

Reef-lines, $\frac{1}{2}$ as big as the Sheet of the Stay-sail, and 6 times as long as the Fore Top-sail Yard.

Rope-bands and Ear-rings, $\frac{1}{3}$ bigger than the Reef-lines, and $\frac{1}{20}$ longer together.

For the Top-gallant Mast.

SHrowds, Cir. $\frac{2}{7}$ of the Di. of the Mast, and $\frac{12}{13}$ of the Mast's Length.

Lanyards, as aforesaid.

Puttock Shrowds, as big as the Top-gallant Shrowds, and $\frac{1}{2}$ of the Length.

Stay, $\frac{3}{4}$ of the Bigness of the Shrowds, and twice as long as the Fore Top-mast.

Tye of the Hallyards, as big as the Shrowds, and $\frac{5}{7}$ of the Le. of one Shrowd.

Hallyards, $\frac{1}{4}$ of the Tye, and as long as the Fore Mast, Top Mast, Top-gallant Mast, and Stump of D°. put together in their extream Lengths.

Lifts, $\frac{1}{2}$ the Shrowds, and $\frac{3}{4}$ of the Hallyards Length together.

Braces, as big as the Lifts, and 3 times the Le. of the Stay.

Pendants, as big as the Braces, and [illegible] of the Length.

Parrel Rope, as big as the Pendants. Le. 2 Feet and $\frac{1}{2}$ for every Inch the Top-gallant Mast is in the Cap.

Bow-lines, as big as the Braces, and $\frac{3}{4}$ of the Length.

Bridles, as big as the Bowlines, and $\frac{1}{4}$ of the Length.

Clew-lines, as big as the Hallyards, and as long as the Braces.

For the Main Mast.

PEndants of the Tackles, Cir. $\frac{6}{22}$ of the Di. of the Main Mast in the Partners. Le. $\frac{1}{3}$ the Length of the Mast.

Runners, $\frac{12}{13}$ of the Pendants, and as long as the Fore Runners.

Tackle-falls, $\frac{7}{13}$ of the Pendants, and 8 times the Length.

Pendant

Pendant of the Garnet, $\frac{1}{3}$ of the Runners of the Tackle, and $\frac{11}{14}$ of the Length.

Guy of the Garnet, $\frac{4}{5}$ of the Pendant, and $\frac{1}{4}$ of the Length.

Garnet Fall, as big as the Main Tackle Fall, and $\frac{1}{2}$ the Length.

Shrowds, as big as the Pendants, and $\frac{4}{5}$ of the Le. of the Main Mast.

Lanyards, as aforesaid. Ratling D°. Worming D°.

Cat-harping Legs and Falls, twice as big as the Worming, and twice as long as the Main Yard.

Stays, Cir. $\frac{1}{2}$ the Di. of the Mast, and $\frac{20}{11}$ of the Mast's Length.

Lanyard, $\frac{5}{14}$ for Bigness of the Stay, and $\frac{2}{3}$ of the Length.

Lasher to the Foremast, $\frac{1}{2}$ the Lanyard, and $\frac{1}{3}$ of the Length.

Worming, $\frac{1}{4}$ of the Stay, and 5 times as long.

Collar, $\frac{3}{4}$ of the Stay for Bigness, and $\frac{1}{17}$ of the Length.

Woulding of the Mast, for every Inch the Mast is in Di. at the Partners, allow $\frac{1}{3}$ of an Inch for the Cir. of the Rope, and 9 times the Le. of the Main Mast for Length.

Crow-foot for the Top, as big as the Worming, and as long as the Cat-harpings.

Tackle for D°. equal in Bigness, and $\frac{1}{2}$ of the Length.

Jeers, $\frac{11}{13}$ of the Shrowds, and 8 times the Le. of each Shrowd, so that each Jeer is four times the Length of each Shrowd.

Lashers to the Yard, $\frac{4}{11}$ of the Jeers, and $\frac{1}{7}$ of the Le. of one Jeer.

Tackles for the Boats, $\frac{1}{2}$ of the Main Tackle, and as long as the Garnet.

Lifts, as big as the Main-tackle Falls, and twice as long as the Main Mast and Yard put together, with $\frac{1}{3}$ of the Le. of the Main Yard added to them.

Strap for the Cap, as big as the Lanyards of the Shrowds, and 5 times as long as the Cap.

Braces, $\frac{6}{7}$ of the Lifts, and 5 times the Le. of the Main Yard.

Pendants, as big as the Braces, and $\frac{1}{10}$ of the Length.

Parrel Rope, Cir. $\frac{1}{2}$ of the Di. of the Mast. And for every Inch the Mast is, allow 3 Feet for Length, as aforesaid.

Nave-line, $\frac{1}{2}$ of the Cat-harpings, or of equal Size and Length.

Racking and Seizing, $\frac{1}{4}$ of the Parrel, and $\frac{1}{2}$ as long again.

Horses for the Yard, worn Rope, $\frac{2}{11}$ of the Jeers, and $\frac{4}{5}$ of the Le. of the Main Yard.

Lanyard, $\frac{1}{2}$ the Horse, and $\frac{1}{4}$ of the Length.

U 2 Pud-

Puddening to the Yard, as big as the Jeers, worn Rope, and 12 Cir. of the Yard in the Slings.

Sheet Cabl'd, as big as the Runners of the Main Tackle, and $\frac{1}{15}$ longer than the Braces.

Stoppers $\frac{1}{2}$ of the Sheets, and $\frac{1}{11}$ of the Length.

Lanyards $\frac{1}{2}$ the Nave-line, and $\frac{2}{3}$ of the Stoppers for Length.

Tacks taper'd, as big as the Shrowds, and $\frac{1}{2}$ the Le. of the Braces.

Luff Tackles, $\frac{6}{11}$ of the Tack, and $\frac{7}{9}$ of the Length.

Bow-lines, as big as the Lifts, and $\frac{1}{3}$ longer than the Tacks.

Bridles, $\frac{6}{7}$ of the Bow-lines, and $\frac{2}{7}$ of the Length.

Tackle $\frac{1}{2}$ of the Bridles, and of equal Length.

Clew-garnets, $\frac{5}{6}$ of the Braces, and $\frac{5}{6}$ of the Length.

Bunt-lines, $\frac{2}{3}$ of the Clew-garnets, and $\frac{1}{2}$ as long again.

Leech-lines, as big as the Bunt-lines, and $\frac{1}{2}$ as long.

Stay-sail Stay, $\frac{1}{2}$ of the Main-stay, and $\frac{1}{2}$ of the Length.

Lanyard, as aforesaid.

Gringles worn, $\frac{5}{7}$ of the Stay, and as long as the Lanyards together.

Hallyards, $\frac{1}{2}$ the Stay, and twice as long.

Sheet, $\frac{1}{2}$ of the Stay, and $\frac{1}{2}$ of the Length.

Tack, $\frac{3}{4}$ of the Stay, and $\frac{1}{2}$ the Le. of the Sheet.

Studding-sail Hallyards, as big as the Stay-sail Tack, and 3 times the Le. of the Main-mast, $\frac{1}{4}$ the Le. added unto it.

Sheet $\frac{5}{6}$ of the Hallyards, and $\frac{1}{2}$ the Length.

Tack, as big as the Hallyards, and $\frac{1}{2}$ the Length.

Reef-lines, $\frac{3}{4}$ of the Leech-lines, and 4 times the Le. of the Main Yard, and $\frac{2}{3}$.

Rope-bands and Ear-rings, as big as the Reef-lines, and $\frac{1}{2}$ as much longer, taken altogether.

For the MAIN TOP-MAST.

SHrowds, Cir. $\frac{9}{19}$ of the Di. of the Top-mast in the Cap, and $\frac{16}{17}$ of the Le. of the Top-mast.

Lanyards, as before.

Ratling $\frac{2}{5}$ of the Shrowds, and $\frac{15}{16}$ for Le. of all the Shrowds.

Pendant of the Top-rope, Cir. $\frac{6}{25}$ of the Di. of the Top-mast For Le. $\frac{12}{13}$ of the Le. of the Main Mast.

Top-

Top-rope Falls, [illegible] of the Pendant, and [illegible] times the Length.

Pendants of Burtons, $\frac{7}{8}$ of the Shrowds, and $\frac{1}{4}$ as long as the Pendant of the Top-rope.

Fall, $\frac{4}{7}$ of the Pendant, and 6 times as long.

Puttock Shrowds, $\frac{5}{8}$ of the Top-mast Shrowds, and $\frac{1}{3}$ of the Length.

Standing Back-stays, as big as the Shrowds, and $\frac{2}{11}$ of the Main Mast and Main Top-mast put together, for all of them.

Lanyards, as aforesaid.

Stay Cabl'd, as big as the Shrowds, and $\frac{6}{7}$ of the Le. of the Main Mast and Main Top-mast put together.

Runners of the Top-sail Hallyards, Cir. $\frac{1}{4}$ the Di. of the Top-sail Yard, and twice as long as the Main Top-mast.

Hallyards, $\frac{1}{2}$ of the Runner, and twice the Length, with the Length of the Main Top-mast added to it.

Lifts, $\frac{1}{2}$ the Runner, and 8 times the Le. of the Main Top-sail Yard.

Beckets at the Cap, as big as the Lifts, and 6 times the Le. of the Cap.

Braces, as big as the Lifts, and $\frac{11}{14}$ of the Length.

Pendants as big as the Braces, and $\frac{1}{10}$ of the Length.

Beckets about the Mizon Mast, as big as the Main Top-sail Hallyards, and as long as the Beckets at the Main Top-mast Cap.

Slings, worn Rope, as big as the Mizon Beckets, and 4 times the Le.

Parrel Rope, Cir. $\frac{1}{4}$ of the Di. of the Top-mast in the Cap, and for Le. allow 3 Feet to an Inch, as aforesaid.

Racking, $\frac{1}{4}$ of the Parrel, and as long as the Slings.

Horses for the Yard worn, as big as the Parrel Rope, and $\frac{15}{13}$ of the Yard for Length.

Sheets, Cir. $\frac{1}{2}$ the Di. of the Top-sail Yard, and $\frac{6}{7}$ of the Le. of the Braces.

Span, worn Rope, $\frac{1}{2}$ the Sheets, and $\frac{1}{13}$ of the Length.

Lashers, $\frac{1}{2}$ of the Ratling, and $\frac{1}{7}$ longer than the Le. of the Span.

Bow-lines, as big as the Hallyards, and $\frac{14}{15}$ of the Length.

Bridles, as big as the Bow-lines, and $\frac{1}{4}$ of the Length.

Clew-lines, as big as the Bow-lines, and 8 times as long as the Main Top-mast, and $\frac{1}{2}$ as long.

Bunt-lines, $\frac{2}{3}$ of the Clew-lines, and $\frac{1}{2}$ as long.

Leech-lines as big as the Bunt-lines, and $\frac{7}{17}$ of the Length.

Reef-

Reef-Tackle-Tyes, as big as the Braces, and as long as the Pendants of the Braces.

Fall, $\frac{1}{3}$ of the Tye, and 3 times as long.

Stay-sail Stay, worn, $\frac{1}{2}$ of the Stay, and $\frac{4}{5}$ of the Length.

Lanyards, as aforesaid.

Cringles worn, $\frac{4}{7}$ of the Stay, and as long as the Lanyards together.

Hallyards, as big as the Reef-tackle Fall, and twice as long as the Stay.

Sheet, as big as the Hallyards, and $\frac{1}{5}$ of the Length.

Tack, as big as the Leech-lines, and $\frac{1}{3}$ of the Lanyard.

Studding-sail Hallyards, as big as the Stay-sail Stay, and 4 times as long as the Main Top-mast, and $\frac{1}{3}$ of the Le. of the Top-mast added to it.

Sheet, $\frac{3}{5}$ of the Hallyards, and $\frac{1}{7}$ of the Length.

Tack, as big as the Sheet, and $\frac{1}{4}$ of the Length.

Reef-lines, $\frac{1}{2}$ as big as the Leech-lines, and 4 times the Le. of the Main Top-sail Yard, with $\frac{1}{4}$ of the Le. added unto it.

Rope-bands and Ear-rings, as big as the Reef-lines, and $\frac{1}{2}$ longer, put together.

For the MAIN TOP-GALLANT MAST.

SHrowds, $\frac{2}{3}$ of the Top-mast Shrowds, and $1\frac{1}{3}$ of the Top-gallant Masts Length.

Lanyards, as before.

Puttock Shrowds, as big the Top-gallant Shrowds, and $\frac{1}{7}$ of the Length.

Stay, $\frac{3}{4}$ of the Shrowds, and twice the Le. of the Topmast, and $\frac{1}{6}$ of the Length.

Tie of the Hallyards, as big as as the Shrowds, and $\frac{1}{4}$ of the Le. of the Stay.

Hallyards, $\frac{1}{2}$ of the Tye, and twice as long as the Main Mast.

Lifts, as big as the Hallyards, and $\frac{2}{3}$ of the Stays Length together.

Braces, $\frac{1}{2}$ of the Lifts, and three times the Length.

Pendants, as big as the Braces, and $\frac{1}{5}$ of the Length.

Parrel Rope, as big as the Pendants, allowing 2 Foot in Le. for every Inch the Top-gallant Mast is in the Cap.

Bow-

Bow-lines, as big as the Lifts, and the Le. of the Braces.

Bridles, as big as the Bow-lines, and $\frac{1}{12}$ of the Length.

Clew-lines, as big as the Bow-lines, and twice as long as the Hallyards.

For the MIZON MAST.

SHrowds, Cir. $\frac{7}{20}$ of the Di. of the Mizon Mast in the Partners. Le. $\frac{3}{2}$ of the Mast, if it steps in the Hold, and $\frac{2}{3}$ if on the lower Deck.

Lanyards, as before. Racling D°.

Pendants, $\frac{7}{9}$ of the Shrowds. Le. $\frac{2}{7}$ of one Shrowd.

Fall, $\frac{5}{7}$ of the Pendants, and 7 times the Length.

Stay, as big as the Shrowds, and as long as the Mast, if it steps in Hold.

Lanyards, as before.

Collar, $\frac{8}{9}$ of the Stay, and $\frac{1}{4}$ of the Length.

Crow-foot for the Top, $\frac{1}{4}$ of the Shrowds, and as long as the Stay.

Tackle for D°, as big, and $\frac{1}{4}$ of the Length.

Jeer, $\frac{8}{9}$ of the Shrowds. Le. twice that of the Mizon Mast, if it steps in Hold, and $\frac{1}{2}$ that Length.

Lasher, $\frac{5}{7}$ of the Jeers, and $\frac{1}{5}$ of the Length.

Parrel Rope, as big as the Lashers, and for Le. allow 2 Feet, as aforesaid.

Truss, as big as the Parrel Rope, and twice as long as the Mizon Mast stept on the Deck.

Slings, as big as the Shrowds, and as long as one Shrowd.

Sheet, $\frac{7}{9}$ of the Shrowds, and as long as the Truss.

Tack, $\frac{5}{7}$ of the Sheet, and $\frac{1}{4}$ of the Length.

Bow-lines, as big as the Tack, and as long as the Slings put together.

Middle Brails, } $\frac{4}{5}$ of the Bow-lines for Bigness, and for Le.
Main Brails, and } 6 times the Le. of the Mizon Mast stept in
Peek-brails, } Hold, and $\frac{1}{4}$ of such a Le. added to it.

Lacing for the Mizon, $\frac{1}{2}$ the Brails, and 3 times as long as the Mizon Yard, and $\frac{1}{4}$ of the Le.

Stay-sail Hallyards, as big as the Brails, and as long as the Sheet.

D°.

D°. Sheet, as big as the Mizon Tack, and half the Le. of D°. Bow-lines.

Tack, $\frac{1}{2}$ of the Sheet, and $\frac{1}{2}$ of the Le. of D°.

For the Cross-jack Yards.

STanding Lifts, as big as the Mizon Bow-lines, and $\frac{1}{2}$ of the Length.

Lanyards, $\frac{2}{3}$ of the Lifts, and $\frac{1}{2}$ of the Length.

Braces, $\frac{2}{3}$ of the Lifts, and 6 times the Length.

Pendants, $\frac{4}{5}$ of the Lifts for Bigness, and $\frac{1}{2}$ of the Le. of the Braces.

Slings, as big as the Mizon Sheet, and $\frac{1}{2}$ the Le. of the Standing Lifts.

For the Mizon Top-mast.

SHrowds, as big as the Main Top-gallant Masts, and as long as the Mizon Top-mast.

Lanyards, as before.

Puttock Shrowds, as big as the Top-gallant Mast Shrowds, and as long as the Lanyards.

Stay, as big as the Shrowds, and twice the Le. of the Top-mast.

Lanyards as before.

Tye, as big as the Stay, and $\frac{7}{8}$ of the Le. of the Top-mast.

Hallyards, $\frac{4}{7}$ of the Tye, and twice the Le. of the Mizon Mast stept on the Deck.

Lifts, $\frac{3}{5}$ of the Shrowds, and 5 times the Le. of the Mizon Top-mast both together.

Braces, as big as the Lifts, and 8 times the Le. of the Top-mast, and $\frac{1}{2}$ that length.

Pendants, as big as the Braces, and $\frac{1}{4}$ of the Length.

Parrel Rope, as big as the Pendants, allowing two Feet in Le. for every Inch the Mast is in the Cap.

Sheets, as big as the Shrowds, and $\frac{1}{2}$ of the Braces for Length.

Bow-

Bow-lines, $\frac{2}{3}$ of the Sheets, and equal in Length.
Bridles, as big as the Bow-lines, and $\frac{1}{2}$ of the Length.
Clew-lines, as big as the Braces, and as long as the Bow-lines.

Other Necessary Ropes.

Viol cabl'd, as big as the Fore Stay, and the Le. of the Gun-deck, and $\frac{5}{11}$ of that Length.

Straps, $\frac{7}{10}$ of the Viol, and $\frac{1}{5}$ that Length.

Lashers, $\frac{1}{2}$ the Straps, and twice their Length.

Pendant of the Winding Tackle, $\frac{4}{5}$ of the Viol, and $\frac{3}{5}$ the Le. of the Main Mast.

Fall of D°. $\frac{1}{2}$ the Viol, and 3 times the Le. of the Pendant.

Pendant of the Fish-tackle, $\frac{13}{16}$ of the Pendant of the Winding Tackle, and $\frac{1}{3}$ of the Le. of the Gun-deck.

Fall of D° $\frac{7}{13}$ of the Pendant, and 4 times as long.

Cat Ropes, $\frac{9}{13}$ of the Pendant of the Fish-tackle, and 7 times the Breadth of the Ship, both of them together, for Length.

Lanyards, as aforesaid.

Stoppers of Anchors, $\frac{11}{15}$ of the Pendant of the Fish-tackle, and each of equal Le. to the Pendant.

Shank-painters, as big, and $\frac{1}{4}$ of the Length.

Stoppers at the Bit, $\frac{4}{5}$ of the Viol for Bigness, and near 3 Feet long.

Seizings, $\frac{1}{11}$ of the Stoppers, allowing 2 Fathom and $\frac{1}{2}$ to one Fathom of the Stoppers for Length.

Lanyards, $\frac{3}{8}$ of the Stoppers, and $\frac{6}{10}$ of the Le. of the Seizings.

Buoy Ropes Cabl'd, as big as the Pendant of the Fish-tackle, and each as long as the Cat-rope single.

Buoy Slings, $\frac{7}{12}$ of the Buoy-ropes for Bigness.

Gun-slings, $\frac{7}{8}$ of the Winding Tackle Pendants, for Bigness.

Butt-slings, $\frac{6}{7}$ of the Gun D°.

Hogshead-slings $\frac{4}{6}$ of the Buts.

Nut-slings of the Guns, $\frac{3}{4}$ of the Hogsheads.

Horses in the Head, worn, $\frac{7}{11}$ of the Gammoning, and 5 times the Le. of the Head, on a middle Line, from the Stem to the Fore-part of the Lion, both.

Lanyards, as aforesaid.

Poop Ladders, worn, as big as the Mizon Jeers, and 7 times the Ship's Draught of Water Abaft for Le. both of them.

Middle Rope, $\frac{2}{3}$ of the Sides, and $\frac{1}{3}$ of the Length.

Lasher, $\frac{2}{3}$ of the Middle Rope, and $\frac{4}{7}$ the Length.

Puttock Staves, as big as the Mizon Shrowds.

Cable Bends, $\frac{5}{11}$ of the Shank-painters or Stoppers for Bigness.

Entring Ropes, generally 3 Inch Rope.

Port Ropes, for every 6 Inches the Port is Square, allowing $\frac{1}{2}$ an Inch for the Circumference of the Rope.

Puddenings of Anchors, as bid as Cable-bends.

Seizings, $\frac{1}{3}$ of the Puddenings.

For the LONG-BOAT.

MAin Stay, as big as the Mizon Top-mast Shrowds.

Tye D°. Hallyards, $\frac{1}{3}$ of D°.

Pendants of Burton, $\frac{1}{5}$ more than the Stay. Fall $\frac{2}{3}$ of the Tye.

Fore Sheets, $\frac{2}{3}$ the Burton-fall. Hallyards D°.

Main Sheet, as big as the Burton-fall. Tack D°.

Boat-rope cabled, as big as the Buoy-ropes, and for Le. let it be the Le. of the Ship aloft, extream.

Guest Rope, $\frac{7}{13}$ of the Boat Rope, and $\frac{1}{3}$ longer.

Painter, $\frac{1}{2}$ the Boat Rope, and $\frac{1}{3}$ of the Le.

Yard Rope, $\frac{2}{3}$ the Hallyards, and twice the Length of the Main Stay.

For the PINNACE.

MAin Sheet, as big as the Long-boat's Fore Sheets.

Fore Sheets, $\frac{7}{8}$ of the Main Sheets.

Boat Rope cabl'd, $\frac{8}{11}$ of the Long-Boat's Rope for Bigness, and as long as the Guess Rope.

Guess Rope, $\frac{1}{2}$ of the Boat Rope, and $\frac{1}{3}$ of the Le.

Painter, $\frac{5}{7}$ of the Guess Rope, $\frac{1}{2}$ of the Length.

The several Sizes of STRAPPINGS *and* SEIZINGS.

Inch.		
7		4 times the Length of one Main Shrowd, or 4 Fathom.
6	——	
$5\frac{1}{2}$	——	$\frac{1}{2}$ that I.e. of the 6 Inches.
5	——	$\frac{3}{4}$ of the 6 Inches.
$4\frac{1}{2}$	——	As much as of 6 Inches.
4	Rope --	D°.
$3\frac{1}{2}$	——	D°.
3	——	D°.
$2\frac{1}{2}$	——	$\frac{1}{4}$ as much more of this than of 3 Inch.
2	——	D°.
$1\frac{1}{2}$	——	As much as of 6 Inches.

And this is sufficient to strap every Block belonging to all the Rigging.

SEIZINGS.

Inch.		
2	——	As much as of the 5 Inch Strapping in Fathoms.
$1\frac{1}{2}$	Rope --	$\frac{2}{7}$ of the 2 Inch.
1	——	11 times as much as of 1 Inch and $\frac{5}{8}$.
$\frac{3}{4}$	——	D°.

Spun Yarn, for every Inch the Main Stay is in Di. allow 5 Hundred Weight.

To every Hundred Weight of Spun Yarn allow 3 tarr'd Lines.

To every tarr'd Line allow $\frac{1}{4}$ of a Pound of tarr'd Mar-line.

To every 30 tarr'd Lines allow one White Line.

To every White Line allow 1 Pound and half of White Mar-line.

To every Hundred Weight of Spun Yarn allow 8 Yards and half of old Canvas.

To every 8 Hundred Weight of Spun Yarn allow $\frac{1}{2}$ a Barrel of Tar.

 For

For every Yard the Main Mast measures on the Superficies that's paid with Rosin, allow one Pound ¼ of Rosin to pay all the Masts.

To every Pound of Rosin allow one Pound and ½ of a Pound of Tallow.

For every 15 Pound of Rosin allow one Gallon of Oil.

To every Gallon of Oil allow 2 Barrels of Blacking, which is for the Masts Heads and Yards to pay them.

For every Fathom of Woulding allow 5 Nails.

To every 300 of Nails allow one Leather Bucket.

To every White Line allow 2 Pound and ½ of Twine, and two Log-lines.

To every Main Shrowd allow 3 Trucks for the whole Rigging.

To every Barrel of Tar allow one Brush.

And for every four Barrels of Blacking one Brush.

AN EXPLANATION OF THE Principal Terms Used in this TREATISE.

ALtho' there are several Writers who profess to explain the Terms peculiar to most Arts and Sciences, yet I could never meet with any but was greatly defective in those used by Shipwrights and Mariners. Therefore to make every thing as plain and useful as possible in this Treatise, I shall here briefly shew the Signification of several Words mentioned in it, many of which I have never observed to be taken notice of in any of our Dictionaries.

A.

AFT; *the after or hinder Part of the Ship, from the Midships to the Stern.*

Apron of the Stem; *a Part brought on upon it to fasten the Butt ends to; or, a false Stem.*

B.

BAck; *the middle Part of crooked Timber, bending outward.*

Back-stay; *that which stops the aft Part of the Mast.*

Bearding; *the working of one part of a Plank or Piece of Timber thinner than the other.*

To

To Belay; *to fasten; so as may be easily loosed again, if requisite.*
Belly, *the Opposite to the Back, or the Inside of the middle Part.*
Bend of Moulds, *or a whole Suit; one of every sort.*
Bend of Riders; *one of a sort of each side.*
Best Bower Anchor; *the biggest Anchor that hangs at the Bow.*
Bevelling; *when any Piece of Plank or Timber is not to be wrought square, but in the Nature of a Rhombus.*
Bills; *the Ends of such Crooked Timber.*
Birthing; *the working up a Ship-side, or Bulk-head,* &c.
Bit-pins; *Pieces of Timber, to which the Ship's Cables are fasten'd.*
Blocks; *sometimes hard knotty Timber to lay under a Ship; otherwise the Timbers into which the Ropes are reev'd, as Pulleys. We call it* Block and Block, *where two Blocks are hal'd together, and the Power or Purchace discontinued.*
Bluffness; *blunt, or full-bodied.*
Bollow; *the Opposite to* hollow. *The Chip is taken at the Edges, as if it was to be laid, or said, in a Hollow.*
Bolts; *the Iron Pins, which fasten one Part of a Ship to another.*
Bolt Rope; *a Bar for the Canvas in every Sail.*
Bow; *the round part of a Ship forward without-board, so called from*
Bowse Ho; *a Watch-word for all the Men haling at a Rope to hale together.*
its Figure. That within is termed the Breast.
Brackets; *generally carved Figures for Ornament.*
Breast-hooks; *large Knees fitted to the foremost Part within.*
Breast Back-stay; *that which is placed at the Side of the Mast, stopping the fore Part as well as the aft.*
Breast of a Ship. *See* Bow.
Breech; *the outward Bending of Knee Timber.*
Bulge; *the outermost and lowest part of a Ship, that which she bears upon when she lies on the Ground.*
Bulge-way; *a Piece of Timber placed on each side upon the Bulge, to slide a Ship into the Water.*
Bulk-heads; *the Partitions in a Ship.*
Butt; *both Ends of every Plank; but in the strictest Sense the ground End, or the biggest End of all Timber.*
Buttock; *the after or hinder part of a Ship from the Water to the Gun-room Port.*

C.

CAmber. *See Snying.*

Canting; *the turning of Plank or Timber from one Side to another, in order to see the Defects, or for any other purpose.*

Catting the Anchor, *is haling the Stock up to the Cat-head.*

To Chamfer; *to take off the sharp Edge from any Square Piece.*

Channels; *Pieces of Plank fixed edge-ways against the Ship's Side, making very near a Right Angle with it.*

Chine; *that part of the Water-way, or any thing that is channel'd, which is thicker than the other part.*

Chok; *a small Piece of Timber fitted to a larger to make out the Substance required.*

Clamps; *Pieces or Strakes of thick Plank on the Inside, as the Wales are on the Outside of the Ship.*

Cock-pit; *two Places under the lower Deck, leading to the Store-rooms.*

Counter; *a part projecting the Stern from the Buttock.*

Cross-pal'd; *Pieces nail'd a-thwart the Ship to every Frame Timber.*

Cross-pieces; *fitted a-cross the Bit-pins, to which the Cables are belayed.*

Crutches *or* Clutches; *large Knees fitted in the Aft part of the Ship in Hold, to bind the parts together.*

D.

DAgger Knees; *such as are placed at some certain Angle between a Perpendicular and the Horizon; the lodging Knees lying near horizontal, and the hanging Knees perpendicular.*

Dead-eyes; *Pieces having three Holes through, in which the Lanyards of the Shrowds are reeved.*

Dead Wood; *the Parts lying upon the Keel abaft and afore, which being covered both within and without, lie hid as if they were buried.*

Decks; *the Plans or Platforms in a Ship, as Stories or Floors in a House.*

Deep Load-mark; *the Horizontal Parallel of the Surface of the Water, when the Ship has every thing aboard that she is to carry.*

Dove-tail; *a Score or Notch cut bigger within than without, for holding fast.*

Draught; *the Model or Figure of a Ship, or any of her Parts, described upon Paper.*

Draught of Water; *the perpendicular Feet which the Ship has under the Water.*

Drifts; *Parts projecting upwards, as far as certain Heights are thought proper to be continued.*

Druxy; *Plank or Timber decayed and spungy.*

To Dub; *to work with an Addice.*

E.

TO Eek; *to fit a Part for the fashioning out another more material, as in the Supporter of the Cat-head, and the Cheeks of the Head, where the Eeking is only applied to continue the Shape and Fashion of the Part, and for little other Service.*

Edging of Plank; *hewing them narrower, according to the Use required.*

F.

FAlse Keel; *a sort of Covering for the principal Keel.*

Fashion-pieces; *two Pieces made exactly alike, and placed one of each side the Buttock of the Ship, to make both sides equal and alike.*

To Fay; *to join Pieces of Timber close together.*

Firs; *smaller Pieces than Choks, but to answer the same Design, in supplying the Wants that may happen in some parts of the Ship.*

Fishing the Anchor; *haling the Flooks out of the Water.*

Flairing; *over-hanging upwards.*

Floor-timbers; *the Timbers in the Bottom of the Ship.*

Fore; *the Fore part of the Ship from the middle forward.*

Fore-castle; *a Place fitted for a close Fight on the upper Deck forward.*

G.

GAskets; *Rope Yarn weaved to make the Sail fast when it's furl'd, or bundled up to the Yards.*

Ground-ways; *large Pieces of Timber lying a-thwart the Bottom of a Dock, or Launch, to make the Foundation firm and substantial.*

H.

HAl'd home; *when the Top-sail Sheets are hal'd to their Places as far as they can be.*

Hanging; *the opposite to Snying, when the middle of the Plank appears lower than the Ends, but circular.*

Harpings; *the foremost Wale-pieces.*

Head of a Ship; *that part which is fasten'd to the Bow or foremost part of the Ship without-board.*

To Heave; *to hale or pull by turning round the Capstan.*

Hold of a Ship; *the part under the lower Deck.*

To Hollow, *is slenderly to gutter a Plank, or any part, that the Edges may fay well.*

Hoodings-ends; *the But-ends in the Rabbits of the Stem and Stern-post, which are more hid by the Rabbits than the other But-ends are.*

Hooking; *the hitching one Plank into another for scoping them.*

Horses for the Yard; *Ropes made fast for the Men to stand upon in furling the Sails.*

I.

JUry Masts; *such as can be got for hoisting the Sails on, when the principal Masts are lost.*

K.

KEdge-Anchor, *is the smallest of all, and generally used to warp or hale a Ship from one Place to another.*

Kevels; *small Pieces of Wood for belaying the Braces and Ropes of a smaller Denomination than the Sheets. And as the Ranges are made in one large Piece, so the Kevels are made in three Pieces.*

Knee; *a crooked Piece of Timber that has one Branch cut off at the Bending, and the other remaining makes the Bend or Knee Timber.*

L.

LAnyard; *a small Rope, which fastens a great one, for the Conveniency of being reev'd in Holes and hal'd taught.*

Lapsided; *when a Ship swims to one Side more than the other, and her Decks not are level to the Horizon.*

To Launch; *to lower or slide a Ship off from the Land into the Water; likewise to leave off pulling, haling, or heaving.*

Lazeretto; *a Place on board of a Merchant Ship, for the Conveniency of the Commander, as Store-rooms are on board of Men of War, to lay up the Provisions and Necessaries for the Voyage.*

To let fly; *to let go, cast off, or loose any Rope at once, without stopping. And when a Rope is so loosen'd, 'tis said to be flown.*

To Line; *to cover one Piece with another; also to mark out the Work with a small Line chalked.*

Load-mark Line; *the Horizontal Line at the Surface of the Water.*

Loof; the aft part of the Bow of a Ship between the Stem and the Midships.

M.

Midships; 'tis generally meant of all the Ship, from the Main Mast to the largest part of the Ship, where the Midship flat, or Midship Floor-timber lies.

N.

NOG; a Trenel drove in at the Foot of each Shore, or the Props that support the Ship in the Nature of trigging the Shore.

O.

Overlaunching; splicing or scarfing one Piece of Timber to another, to make firm Work.

P.

Partners; Pieces fixed to steddy the Masts and Capstans, having a Hole through each to receive the same.

Paunch; thrum'd Mats, much for the same purpose as Puddening.

Plansheers; the finishing part at the Top of the Ship-side, which ought to lie direct and level.

To Plum; to hew any Piece downright, or perpendicular.

Plummet; a Weight hanging by a Line to prove the Plumming.

Poop; the uppermost Deck abaft.

Preventers; Ropes that have Wale Knots at each End, chiefly used in Sea-fights. For when the Rigging is in part shot, such Ropes are apply'd to prevent the damaged Ropes being quite broke off.

Project; any thing that juts out in the Building; as of the Counter, Wales, &c.

To Pudden the Yards, to nail Pieces of old Rope round them, to preserve them from galling.

Q.

Quarter; the upper after part of the Ship on the Outside, and may be reckon'd to commence from the middle of the Ship.

Quarter-pieces; large curved Pieces, fixed to terminate the Quarter with the Stern.

To Quicken the Sheer; to shorten the Radius that strikes out the Curve. Its Opposite is Straightning the Sheer.

Quick-work; that part of a Ship's Sides both within and without Board, above the Channel-wales and Deck. 'Tis commonly perform'd with Fir-Deal, which don't require the fastening, nor the Time to work it, as the other parts, but is Quicker done.

R.

RAke of the Stem and Stern-post; *that part of the Ship's Hull that is extended fore and aft, from the straight or horizontal Line of the Keel.*

Ram-line; *a Line made fast at the Stem and Stern-post, hanging crooked by being weighted in the middle.*

Ranges; *Pieces fitted to the Ship to belay or fasten the Main and Fore Sheets.*

To Reconcile; *to make one Piece of Work answer to the Uniformity of the other next to it, and more particularly in reverting of Curves.*

Ribbons, *or* Rib-bands; *so called from binding the Ribs or Ship's Timber together.*

Riders; *Pieces fixed on the Inside of the Ship on the In-board Plank, something imitating the Ships Timbers or Ribs.*

Rough Timber; *that which is only cut down, and the Boughs lop'd off. Being hew'd into Squares, 'tis said to be* Rough-squar'd *according to the different Species.*

Round-stern'd; *to have sharp or pointed Sterns, as Square Sterns are blunt and flat.*

Runner; *a single Rope that runs or is hal'd in a Block.*

S.

SCantling; *the Length, Breadth, Depth or Thickness of any part of the Ship.*

Seams; *the Chinks into which the Oakam is drove between the Strakes of Planks.*

To set Sail; *to loose the Sails, and manage them to the Wind.*

To shorten Sail; *is to hale some up in order to furl them.*

Season'd Plank *or* Timber; *such as is throughly dry, and will not be apt to shrink.*

Sheet-Anchor; *bigger than either of the Bow-Anchors.*

Shaken Plank *or* Timber; *such as is full of Clefts, and will neither bear calking nor fastening.*

Shank-painter; *a Chain, or a large Rope, to secure the Anchor, and passed about the Shank of the Anchor.*

Shifting Planks; *the putting one But-end clear of another.*

Sholes; *Pieces of Slabs put under each Shore for the better securing the Weight.*

Shivering; *when the Sail shakes, and is not filled with the Wind and bunted out.*

Shrowds; *Covering, Roofing, or Doubling the Masts.*

Sir-mark; *a particular Mark made to guide the Workman in placing the Parts.*

Sleepers; *thick Strakes of Plank lying fixed in the Bottom of the Ship.*

Snying; *an arching upwards, where the Middle of a Plank appears higher than the Ends.*

Sole of Planks; *the flat Side of them.*

Spirkit-rising; *the Plank fixed between the Decks and the Ports, for raising up the Side within-board.*

Standers; *Knees fitted upon any of the Decks; also Pieces placed to raise Stages or Scaffolds.*

To Steal; *in planking, is to have more Strakes in the Middle of the Ship, than at the Stem or Stern-post.*

Steaving; *when a Part rises from a horizontal Position, as in the Cat-head, Bowsprit, and Knee of the Head.*

Stem; *the intire foremost part of a Ship.*

Steps for the Masts; *large Pieces of Timber fitted at the Bottom of the Ship to steddy and secure the lower part of each Mast, which is also called a Step.*

Stern-post; *the hinder part of a Ship.*

Strake of Plank; *one Breadth of such Materials wrought either within board or without, from one End of the Ship to the other.*

Stream Anchor; *which stops the Ship in tiding up a River.*

To Strike, *to draw a Line, or delineate a Circle.*

Strings; *parts used to strengthen; and what are called Clamps in the lower parts, are termed Strings upwards.*

To Sweep; *to describe or mark out a Circle with any Instrument; And the Circle so marked out is generally called a Sweep.*

T.

TAck-piece; *that to which the Fore-sail is tack'd down.*

Tasting of Plank or Timber; *Chipping of it with an Addice to try the Defects.*

Tackle Fall, *the Rope that being reev'd in Blocks or Pullies, is handed down to the Deck to be hal'd.*

Taught or Tight; *the stretching a Rope, that it may not hang slack or loose.*

Term-pieces; *the finishing Pieces, or those which terminate the Drifts.*

Thick-stuff ; *all Plank (as it may be termed) which is thicker than 4 Inches.*

Throat ; *the inward bending of Knee-timber.*

Top-sail a-trip ; *when 'tis hoisted as high as it can.*

Top-timbers ; *the uppermost Timbers in a Ship.*

To trim a Ship ; *to load and equip her, and put her into a condition for Sailing ; also to calk, clean, and dress a Ship, and do any small matter in repairing her, or to fine-draw the Plank or Timber.*

Tumbling home ; *when the Ship-side declines from a Perpendicular upwards, or, as some call it, houses in.*

V.

Viol ; *a large Hawser used to heave in the Cable.*

W.

Wake, or Way ; *the Bringing one part of a Ship too near another.*

Wales ; *Pieces, or rather Strakes of thick Plank, by which the Ship is regularly sheered or curved, and which also projects without the other Plank several Inches.*

Wall-sided ; *when the Ship's Side upward is built upright or perpendicular.*

Waste ; *that part of a Ship upon the upper Gun-deck between the Bulk-head of the Steerage and Fore-castle.*

Water-ways ; *thick Plank channel'd or gutter'd, and fixed on the Decks next to the Ship's Side.*

Within-board ; *within-side of the Ship ; as* Without-board, *on the outside.*

Winding ; *when the Plank or Timber's Side or Edge is not upon a direct Plan, but seemingly twists.*

Wood and Wood ; *when a Trenel is drove through, that the Point of it is directly with the Plain of the Plank through which 'tis drove.*

Woulding ; *the binding about a Mast, or the like, with Ropes.*

Wrung-heads ; *that part between the Floor-timber Head and second Foot-hook Heel, which, if a Ship lies on the Ground, bears the greatest Strain.*

FINIS.